CERAMICS

FEBRUARY
1952

lo. 36 Vol. III

AP

LONDON

A monthly journal covering the whole ceramic field including pottery, glass, heavy clay, refractory and silicate industries.

Published Monthly
by
ARROW PRESS LTD.,
157 Hagden Lane,
Watford, Herts

Price 2/6d. per copy.
25/- per year, payable in advance.

CERAMICS

FEBRUARY, 1952

FEATURE ARTICLES

MISCELLANEOUS

Copy and Blocks should be available to us by 14th of the preceding month.

They should be sent to:

CERAMICS
157 Hagden Lane, Watford, Herts
Telephone: Gadebrook 2308/9

Ceramics

VOL. III | FEBRUARY, 1952 | NO. 36

PROBLEMS

ON another page "Argus" deals with the Reconstruction Committee investigations which are now taking place in Stoke-on-Trent.

On the one hand the pottery industry is begged and cajoled to do everything possible to maintain its output; and as a hard currency earner it has received praise from many quarters. However, its path has not been an easy one. It was faced with restrictions on building for factory extensions during the years immediately following the war. It had to build itself up from practically nothing during the war years to something which was to be "sold" on decorative appeal.

Modernisation was carried out without interfering with production. The industry was compelled to develop the overseas market and no encouragement whatsoever was given to the home market—which meant that the industry faced a tremendously difficult task, and pretty well at its own expense! Having achieved a large measure of success in the post-war years, judged by any standards, it heard the rumblings of difficulties in the export market about a year or so ago. General MacArthur was apparently doing nothing about flagrant copies of British designs from Japan, which were appearing with increasing frequency in America. Now, with American support, Japan is approaching its pre-war potential, when it held something like a third of the world's export trade in pottery. Likewise problems are faced with German competition.

The manufacturer this year has been confronted with increased gas and electricity tariffs for his tunnel kilns—which means, in effect, that where a plant was to be written off over 5 or 6 years it must now be written off over 7 or 8 years. A matter of little importance to anyone other than the person responsible for keeping his factory on a sound financial basis. The manufacturer is now confronted with wage demands from the industry.

In every instance there is a good and strong case for all these increases but in the overall result it looks very much as though the conjoint effort will kill the goose. . . !

Manufacturers, suppliers and employees must surely see the reason in this!

NEROISM IN THE POTTERIES

by **ARGUS**

BRITAIN faces trouble in Egypt, in the Sudan, in Persia, in Malaya. Britain has an adverse balance of trade. Britain is struggling to obtain raw materials and food. In short, the problems are immense and all political parties agree that the only basic solution is the use of every means possible to produce more and more goods as near as possible to a competitive price on the world markets, related in turn to maintaining as high a standard of living at home as is possible.

A £15 million Project

Yet, in the midst of this struggle for survival, there is taking place at Stoke-on-Trent the most fantastic time-wasting enquiry that it is possible to imagine. The legislators in Whitehall demanded that local authorities should prepare planning schemes at the same time as a national economic crisis was blowing up. And what is more they laid down the maximum period within which any objections could be heard. The net result of this has been a reconstruction scheme for the potteries which turns out to be a £15 million project, for this is the estimated cost *now* to replace and rebuild the seventy-five factories which are affected by the plan. This, in itself, when related to the annual pottery exports of £27 million, very largely to the "hard currency" areas, sounds fantastic enough. It seems that the planners fondly imagine that nothing has been done in the way of factory reconstruction in the Potteries. Factually, in the period since the war something like £3 million of capital investment in the factories affected by the plan, resulting in new buildings, new slip houses, new tunnel kilns and so on has been undertaken. The British Ceramic Research Association estimate that from 1937-50 the smoke nuisance in the potteries has been reduced by 60 per cent.

40 Years On

The next thing that happened was that the reconstruction committee made recommendations to the Stoke City Council to the effect than any development plan will not interfere with existing pottery factories for a period of 40 years from the date of the approval of the development plan with, of course, certain provisos:

1. The factory must be modernised and be in a well-maintained condition.
2. No solid fuel must be used.
3. A factory must be used only for the manufacture of pottery and substantially the whole of the factory must be in use.

These provisos are in themselves the kind of restrictions which are often encountered from people who are not conversant with the practical problems of day-to-day production. How does one define modernisation or efficiency? What is meant in principle by the fact that no solid fuel must be used? On top of this it would appear that the chairman and vice-chairman of the reconstruction committee are empowered to alter the plan in any way they like at the enquiry.

The stipulation of 40 years is, of course, a pipe dream.

A Typical Case

To understand the precise nature of this planning orgy, the case of W. T. Copeland and Sons Ltd., established on the site since 1720, is worth examination. Apparently the site of the world-famous Spode factory is to be converted into a transport centre

with a number of largish warehouses, and part of it will be a park!

Mr. Hewitt, the joint managing director, pointed out that since 1935 one-quarter of a million pounds had been spent on capital costs and twenty-three intermittent ovens consuming approximately 2,000 tons of coal per year had been replaced by continuous firing. By June of 1952, it was expected that four more intermittent ovens would go, saving another 1,400 tons of coal per year. And this was only for work primarily on the earthenware side of the business. Plans for the reconstruction and modernisation of the china side over the next 6 or 7 years were in hand at a cost of another quarter-of-a-million pounds. The factory employs more than a 1,000 people and 80 per cent. of the output goes for export.

It is but one typical instance of the manner in which most of the firms in question have approached the demands made upon them in the last few years by the Government to increase their exports. There is evidence indeed that the reconstruction committee under-estimated the extent of the new land required for the evacuated potteries to the tune of 100 acres. A mean error of round about 25 per cent.

The enquiry is going to go on obviously for many weeks, and as far as one can see many people are going to waste time from their normal jobs whilst only the non-productive lawyers are likely to enjoy themselves!

The Wrong Time

It stands out crystal clear that with the country facing an economic crisis which is of world origin and which will mean that the greatest possible efforts must be made merely to maintain our present standard of living, we cannot afford to think in terms of gilding the lily. Manufacturers are confronted with the problem of producing more and more at minimum prices if they are to survive against the American subsidised exports from Japan and Western Germany.

This in itself is a time-consuming operation.

Yet they are expected to have their efforts strangled by the thought that every move they make leaves them in the insecure hands of a galaxy of planners who blissfully sit in Whitehall and organise towns like Stoke, Newcastle, Liverpool, and Manchester, which, to them, often mean only names on the appropriate railway stations.

In the past we have become used to plans—undoubtedly from 1945-50 will become known as the "Planning Age" in Britain. Yet plans in themselves earn not a penny piece and do in fact add to the overheads of the community. Even plans which are likely of fruition fall into this category, but plans on a grand scale which every sane and sensible individual must realise cannot possibly be implemented in our lifetime are nothing more than waste in its most ruthless form. For every hour that this enquiry sits, so will the export trade in pottery be reduced through loss of time, by executives in the industry briefing their directors, and by a lack of security of the pottery manufacturers resulting in their taking a more careful approach towards modernisation in the light of an uncertain future.

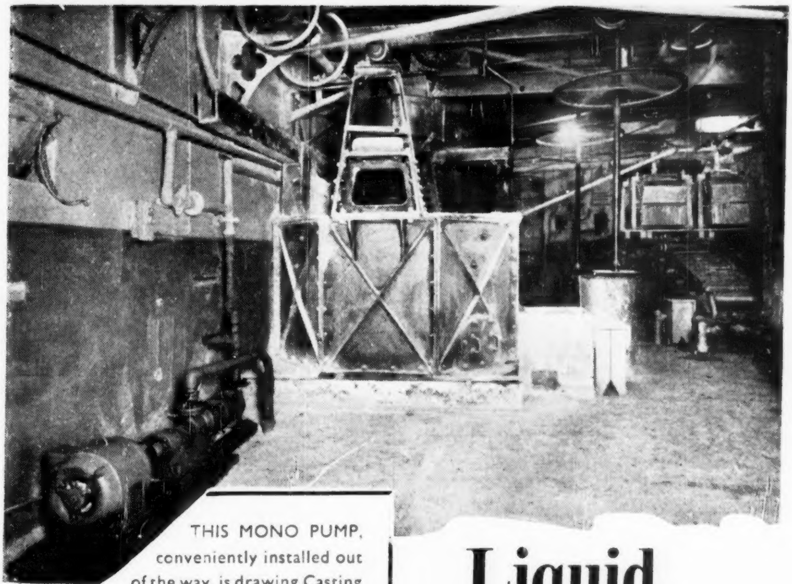
No Security

It is overlooked that reconstruction needs capital and capital can only be forthcoming in the money market when some definite security can be offered to the potential investors. With the possibility of wholesale evacuation within 40 years the investor is hardly likely to take very kindly to this industry as an investment!

Thus, by these methods, planning experts are reducing the national value of pottery exports which in turn means that they are aggravating the national problem of buying more food and raw materials.

With such an unrealistic scheme in operation is it not desirable that the Government stepped in, closed the door, and deferred the enquiry for another 40 years in the hope that by then "things might be better."

British Ceramic Society.—The Spring meeting of the Building Materials Section, will be held on 13th March, in the Mappin Hall, The University, Mappin Street, St. George's Square, Sheffield 1.



THIS MONO PUMP, conveniently installed out of the way, is drawing Casting Slip 12 feet from an underground reservoir and pumping to the magnetic sifter.

Liquid Abrasion?

The abrasive content of Casting Slip, Flint or Stone Slop or Glaze can take heavy toll from pumping equipment. The unique principle of the Mono Pump providing a rolling motion between rotor and stator, together with the low and uniform velocity of flow, contribute towards a considerable resistance to wear from abrasive compositions. There are no valves. On filtration duties this steady flow produces a firm and consistent cake and can improve the quality of slip.

Operating delivery on gland there is a complete absence of aeration when pumping to the casting shop.

Add to these advantages, self priming, easy maintenance, space saving and lack of noise when operating and it is clear why so many Ceramic Engineers choose the Mono Pump.

The MONO pump

MONO PUMPS LIMITED

MONO HOUSE, 67 CLERKENWELL ROAD, LONDON, E.C.1

Tel: Holborn 3712 (6 lines) Cables: Monopumps, London Code: A.B.C. 7th Edition

Branches at Birmingham, Dublin, Glasgow, Newcastle

MP195dm

KILN FURNITURE AND PLACING ACCESSORIES

Their Manufacture and Use

(SPECIALLY CONTRIBUTED)

IT is obvious that, in firing glost, steps must be taken to separate the individual pieces, or the result is stuck ware. Considerable ingenuity has been displayed over the years in devising means of doing this. It is a continuously evolving process, new means of firing calling for new methods, or modifications and improvements on the old.

Requirements for Glost Placing

The pieces used for glost placing must have the following properties:

1. They must be vitreous or nearly so, to prevent the ware being sucked.
2. They must be capable of taking sharp points in manufacture, so that the area of contact with the ware is as small as possible.
3. They must have sufficient strength at firing temperatures to support the load without collapsing.
4. They must occupy as little of the firing space as possible, and
5. Above all they must be cheap.

The importance of these points needs little further elaboration.

It is obvious that the ware must be marked where the support touches, and so it is arranged that this occurs on the back of the ware, and the smaller the area the less polishing is required to remove it. Good refractoriness under load is essential so that the weight of the supports can be reduced to a minimum without fear of losses by collapsing. Since the sharp points on which the ware rests become glazed in firing, it is preferable to throw them

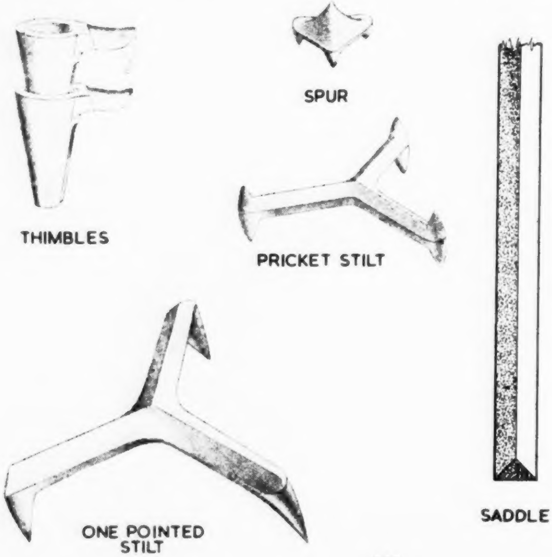


Fig. 1. A small selection of the many types of pieces for glost placing

(Courtesy, T. Arrowsmith and Sons, Burslem)

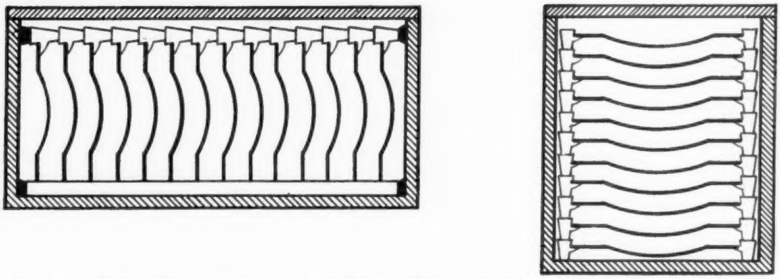


Fig. 2. (Left) Flat ware reared with saddles and thimbles. (Right) Flat ware dottled on thimbles

away after firing once. This means that some part of the supporting mechanism, e.g., pins of cranks, must be as cheap as possible. These articles must therefore be mass-produced, and explains why their manufacture is concentrated in the hands of a few specialist firms.

Placing in Saggars

Where firing is done in saggars a number of comparatively small pieces are used to separate the ware, the saggar being the container. Where the ware is open set on tunnel kiln cars or bats, various types of crank are employed. These in turn rest on bats supported on props forming the kiln superstructure.

Fig. 1. shows a very small selection of the thimbles, stilts, spurs, etc., used in placing glost in saggars. The large variety of types and sizes demanded by different manufacturers is a problem for the specialist firms who make them, since the number runs into hundreds, and the provision of the necessary dies for their manufacture is an expensive business. Attempts are being made, with some success, to standardise a smaller number of designs, to the mutual benefit of producer and user.

Manufacture of Thimbles, Stilts, Spurs, etc.

Spurs and stilts are either roughly triangular in shape or consist of three arms meeting at the centre of a triangle formed by the extremities of the arms (Fig. 1). The body employed is either a mixture of vitreous ball clays or a vitreous earthenware type body. It is blunged, lawned, and pressed up in the usual way, and is then extruded through a pug mill in bars of roughly the required cross section, by the use of a suitable die. After drying to leather hardness, these are cut off to pieces of a suitable thickness, which are then pressed to the correct shape with the points in the required positions. Thimbles are made similarly by extruding the body in slabs. From these the thimbles are formed by two pressing operations at a very fast rate. Saddles are formed by extrusion and cutting to length. After drying, the pieces are packed in saggars and fired to 1,200° C.

Use in Glost Placing

Fig. 2 shows the use of these saddles and thimbles for packing glost into saggars. Stilts are used for placing holloware, and sometimes for stuffing small pieces inside large ones to improve the oven count. Very large pieces such as sanitary ware call for no special accessories apart from special saggars, or props and bats. Great skill is required to pack the ware to the best advantage. Sinks are usually reared on four clay supports, and the marks are subsequently covered by glazed buttons cemented on.

Open Firing in Tunnel Ovens

Since the end of the last war there has been considerable development in the use of tunnel ovens for firing, and in many of these saggars are no longer used, the ware being set on the cars. This has necessitated the manufacture of various types of crank for holding glost ware, and bats and props for building up the kiln superstructure.

Most of these are either dust pressed or cast, and are made to surprisingly accurate dimensions. Much research has been done, and is still being pursued, into improving the body mixtures used. The requirements for the body are similar to those outlined earlier.

Casualties with Cranks

Casualties with cranks arise more often from careless handling than from failure of the refractory. One manufacturer estimates that 75 per cent. of the casualties to cranks are caused in this way. Even then the losses are not high, so that the use of expensive refractories is hardly likely to be justified unless the crank can be made almost indestructible. This does not mean that new materials will not be used, but the use of certain materials for cranks would at present appear unlikely.

At present, mixtures of refractory clay and molochite (a china clay product) are very popular. These are either cast or dust pressed. In the most modern works the cranks, etc., are fired in tunnel ovens to a maximum temperature of around 1,290° C.

The evolution of the crank goes forward steadily, the aim being to simplify the manufacture, to increase the ratio of pay load to setting material, to decrease losses in handling and firing, to eliminate the need for polishing, and to provide easy storage when not in use.

Evolution of Crank Pillars and Ware Supports

Much has been accomplished by improvements in design. Earlier types involved the use of pillars which were fitted into bases, and to hold the ware pillar rings rather resembling thimbles were threaded on the pillars. The latter were made of metal, and the crank was used in decorating kilns.

Fig. 3. Patented crank showing use of pillar rings. Pat. No. 467373/37

(Courtesy, J. Gimson and Co. (1919) Ltd., Stoke-on-Trent)

Similar cranks are still used in glost kilns, the pillars being made of a ceramic body. In one popular type the pillar rings are notched so that they cannot twist around the pillar while the ware is being placed (Fig. 3). The rings are discarded after use.

The latest designs embody dust pressed pillars, with expendable pointed pieces on which the ware rests. These take the form of pins inserted into the pillars, or pointed studs (pips) which rest on horizontal projections of the pillars (Figs. 4 and 5). Machines have been developed to insert the pins or studs into the pillars. Very cheap prices are quoted for the pins and studs to encourage potters to use them only once. The former are mass produced by extrusion using a special purpose patented machine, while the latter are dust pressed.

Fig. 4. Pin crank

(Courtesy, J. Gimson and Co. (1919) Ltd., Stoke-on-Trent)

Reduction in the Number of Crank Sizes

The large number of crank sizes required for the different types and sizes of ware has encouraged designers to produce a multi-purpose

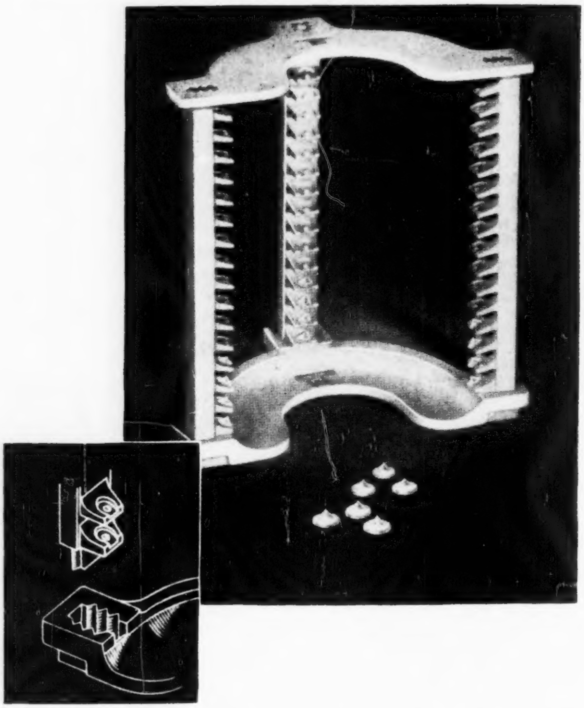


Fig. 5. Crank showing pips used for supporting ware and multiple vee fitting. Pat. No. 660893

(*Courtesy, J. Hewitt and Son (Fenton) Ltd., Stoke-on-Trent*)

crank. The heights of cranks have now been more or less standardised and the number of different sized bases has been reduced by the adoption of a multi-vee socket for the pillars or by the use of different sized pins. This socket eliminates the need for a cement for holding the pillar to the base. High quality china glost is fired on a different type of crank. The same principle of the expendable pin or stud for making contact with the ware is used (Fig. 6).

Tile Cranks

Coloured tiles must be fired in a flat position to prevent the glaze running to one side and causing shading. This is done with a crank in the form of a shallow box with two sides missing. White tiles are an easier problem, since shading does not occur with unequal glaze thickness. Such tiles can be reared back-to-back in a special crank which permits a great saving of setting space (Fig. 7).

Designs of furniture for kiln cars are also continually evolving and some remarkable pieces of precision work are now made. Bats are dust pressed to standard sizes. Sillimanite-clay mixtures are widely used, and so is silicon carbide. The latter finds particular application to kilns where the cars have to carry very heavy loads, as its great strength at elevated temperatures enables the amount of pillars and bats to be greatly reduced in comparison with other materials (cf. CERAMICS, January, 1952).

After firing there may be slight differences in the height of the pillars, or the kiln deck may not be perfectly flat. To counteract this one firm has introduced a pillar head which incorporates a helical thread, so that, by rotating it the height of the short pillar may be increased, and the bat made level. Bats and props have been designed to allow for expansions and contractions, and in one design the pillars may be canted 15° out of the vertical without the superstructure collapsing.

Open firing in open flame kilns has attracted some attention recently in the attempt to reduce firing costs. Some manufacturers protect the ware by bats inserted into the side of the superstructure, which virtually boxes it in (Fig. 8). These bats must not deform in firing or be sensitive to thermal shock. They must also be removable with ease. It is interesting to note that some success is being achieved with this type of setting in firing bone china biscuit.

Modifications for Multipassage Kilns

The introduction of multipassage kilns of the Gottignie type has called for modification of the usual types of kiln furniture. In this type of kiln the ware is passed through a passage 12-15 in. wide and 4-6 in. high on refractory bats. It is important that these shall possess sufficient mechanical strength at the temperatures involved, and that they shall not distort, since the opposite faces are initially ground flat and parallel to prevent dog-legging and grinding against the side of the kiln. On the Continent refractory clay grog mixtures, containing about 20 per cent. talc, are used to dust press these bats. In this country sillimanite-clay and molochite-clay mixtures have been used.

For glost placing the bats are pierced with rows of holes. In these are placed short crank arms fitted with the expendable pins or pips already described. The spacing of the holes makes it possible to accommodate all the usual sizes of ware. For glazed tiles one manufacturer inserts vertical pegs into the holes of the bat. Each peg is fitted with horizontal arms at convenient heights and the tiles rest on these.

It is quite certain that new designs in kiln furniture will be forthcoming as long as man's ingenuity persists, and what was regarded as the last word in cranks, for example, a few years ago has been replaced by better models, and so the process goes on. It is interesting to note that we occasionally find that the modern idea has been tried unsuccessfully many years ago. The present makers of the pin crank tried to interest the trade in pins for supporting glost about 30 years ago.

The trend of development in

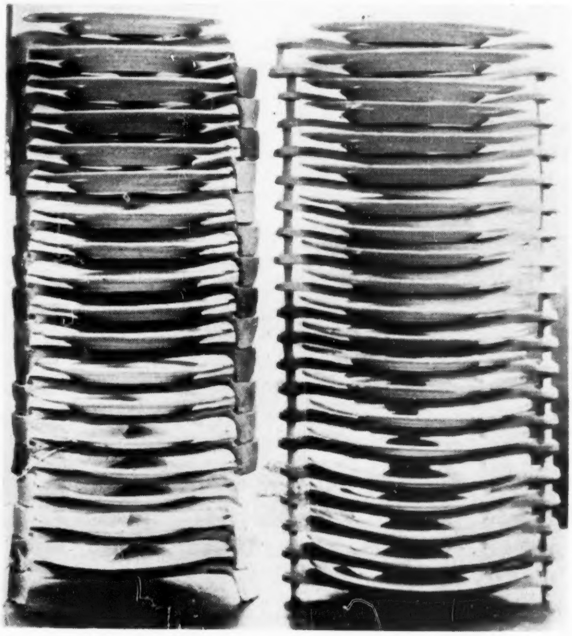
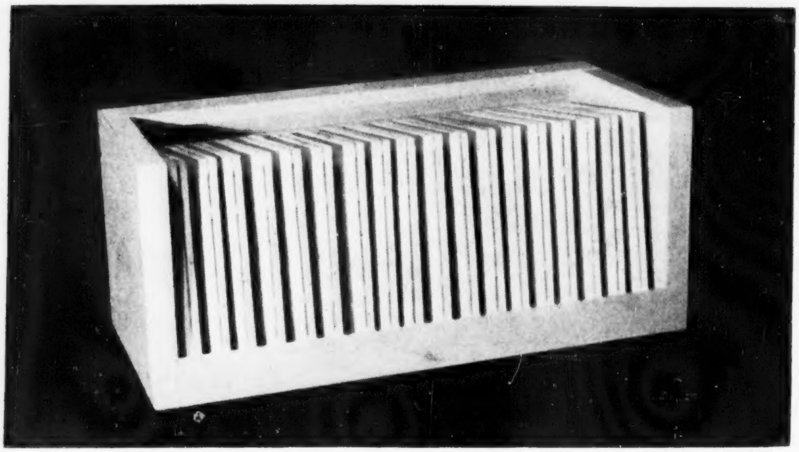


Fig. 6. (Right) The Hewitt - Doulton crank for setting bone china plates (Brit. Patent 647621, J. Stanistreet and R. Bentley) showing increase in number of plates which can be set in a given height over older type of crank (left). Ware can be inserted from side without dismantling cranks



(Courtesy, Sneyd Brickworks Ltd.)

Fig. 7. The Sneyd tile crank for white glost tiles. Pat. applied for. Reg. Des. No. 864295

refractory materials for kiln furniture, etc., has been described by J. Walker (*Trans. Brit. Ceram. Soc.* **49,** 455, 1950) who has given an account of some of the trends of research being pursued by a well-known company in this field.

Examples are given of the value to the designer of determining curves for the relationship between the various

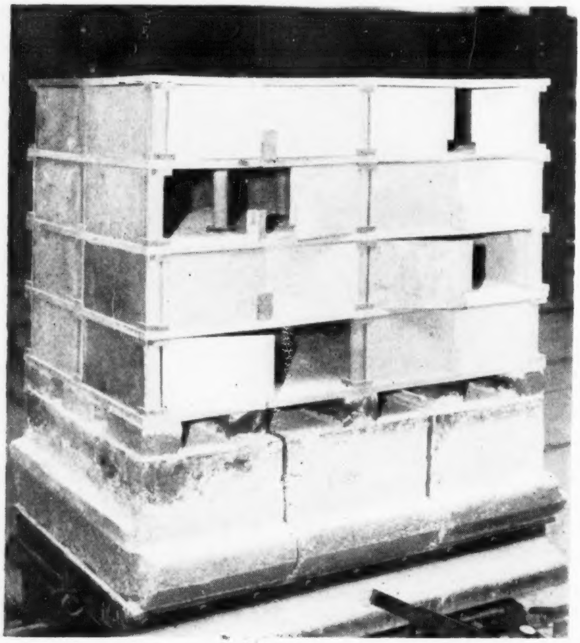


Fig. 8. Kiln superstructure developed by Acme Marls Ltd., Burslem, for open fired kilns. Pat. Nos. 646263, 635047, 643809. Pat. Applications 12413/51, 10166/51. U.S. Patents 226574, 2537145

important factors. These are critical stress, payload, payload/kiln furniture ratio, area and thickness of bat. Since these can all vary the simplest way of representing the information is to keep two of the variables constant and to plot the relationship between the others. Typical examples are given to show the value of this approach over the old hit and miss methods.

The determination of the hot strength of the material is also described, and it is emphasised that deformation at high temperatures can be avoided by developing materials with interlocking crystals rather than those in which the crystals are embedded in a relatively large amount of glassy substance, which is liable to plastic deformation or melting when the temperature is high enough. Sometimes the crystal development is favoured by high firing temperatures, and examples are given to show the improvement in deformation resistance effected by firing clay-bonded sillimanite to higher temperatures.

Value of Records

The author emphasises the help which can be given to the manufacturer by regular keeping of records of the performance of kiln furniture in service, and makes a plea for standardisation of shapes, etc. He believes that further progress in the performance of the refractories used in kiln furniture will follow from improved methods of mixing and firing, and mentions the value of statistical methods and quality control charts as controls in manufacture.

TRADE MARKS AND TRADE NAMES

THE 7th edition of "Kerly's Law of Trade Marks and Trade Names" has been published by Sweet and Maxwell Ltd., 1,053 pp., price £7 7s. It has been written by R. G. Lloyd, M.A., B.Sc., Barrister-at-Law, in collaboration with the late F. E. Bray, K.C. For many years this book has been recognised internationally as the standard text-book on the law of trade marks, trade names and trade descriptions, including merchandise marks. The commercial importance of trade marks has been increasingly recognised in all branches of business and the new "Kerly" has been prepared to meet the needs not only of the lawyer but of the business man himself.

It is the first edition of this book since the Trade Marks Act of 1938 which introduced conceptions of a wholly novel character into trade mark law. In many ways a trade mark can be an even greater asset to a firm than a patent itself. The trade mark shows the origin of the goods and executives of business firms might be well advised to have this book at hand before they get too far immersed in publicity schemes in which they give their goods new names. Trade mark law is full of pitfalls for the unwary. The book describes simply and fully the procedures at the Registry of Trade Marks for lodging trade marks. It outlines the essential characteristics which trade marks must have before they can be registered and how to avoid making the trade mark invalid once it is registered; it shows how to prevent people using the same or similar trade mark; it covers unregistered trade marks and what is commonly known as "passing off," and deals with many questions on an international basis.

The index is comprehensive and all important legal cases have been referred to. Extracts from some of these cases help to clarify many difficult points of practice. The writers of the book have had wide experience in trade marks litigation as members of the Bar and this is obviously invaluable not only to lawyers but to members of those firms concerned with the marketing and advertising of every type of commodity.

Sturtevant Engineering Co. Ltd.—Five new publications, Nos. 8501, 8901, 9102, 9301 and 9401, deal respectively with the Sturtevant Batch Mixers and Blenders for use in mixing or blending two or more dry materials; Swing Sledge Mills; Ring Roll Mills for grinding a variety of materials from bauxite to coal and coke; Rotary Fine Crushers and Roll Jaw Crushers. Application should be made to the Sturtevant Engineering Co. Ltd., Southern House, Cannon Street, London, E.C.4.

FINE POTTERY OF THE NETHERLANDS

by

JOHN GRINDROD, B.A.(Com.)

WHEN thinking of Dutch pottery one immediately brings to mind that attractive ware known for years as "Delft-Blue," with its pleasing texture, its warm white tint and its decorations in fine clear blue or other colours. Indeed, so associated with Holland and so tied up with Dutch tradition has this become, that, when a poll was recently carried out among visitors to Holland, it was disclosed that no less than a quarter of them were taking back Delft pottery as souvenirs.

Covered jar in Blue Delft ware. Height 26 in., frieze with Dutch landscape decoration running round the body. Made by De Porceleyne Fles

Enjoying such popularity, it is not surprising that fine Dutch pottery is being exported in increasing quantities and is finding its way into more and more of the world's markets.

Centres of Industry

Although "Delft-Blue" has come to be almost synonymous with Dutch pottery, other types are manufactured in the Netherlands, and there are a number of definite localities in the country, where the industry has become established. From each of these come products clearly distinguishable in character. Wares made in the various centres are not only different in form, colour and decorative motifs, but are sometimes strongly divergent in the materials used and in the manner of their treatment. The principal centres of the industry are the towns of Delft and Gouda in the province of South Holland, the village of Makkum in the northerly province of Friesland and a few localities in the province of Limburg in the extreme south of the country.

There are, at present, some forty-six potteries of significant size making household ware in Holland. In addition to these larger firms, there are very many small firms, each manufacturing its own special line, which, in the aggregate, amount to quite an extensive industry and cover a wide range of products.

As well, there are about fifty potteries which concentrate on decorative pottery specialities and artistic and religious wares.

The total number of operatives employed in the industry in the Netherlands amount to about 8,000 in all sections.

Unfortunately for the Dutch, very little suitable clay for the industry is

Covered jar and vase in Blue Delft ware with decoration. Sets of these are used to decorate large cabinets. Height, jar 26 in.; vase 19 in. Made by De Porceleyne Fles

found in Holland, and only in a few localities are indigenous clays used wholly or partly in the potteries. For this reason most of the industry's raw materials have to be imported, chiefly from Germany, Great Britain, Czechoslovakia and France.

Chequered Career

Strongly established as the Delft-ware is in the Netherlands, it has not always been blessed with fortune's smile and it has had a chequered career. Its history goes back to the first half of the 17th century, when the already established industry at Delft, built up chiefly on the style of the Italian majolica, was influenced by the arrival in Europe of the first appreciable shipments of porcelain from the Far East. Dutch potters succeeded in outwardly copying the lovely blue and white Ming china, the polychrome decorations of the porcelain of the Ch'ing dynasty and the "Arita" and "Imari" ware with underglazed and muffle decorations from Japan. Later they developed a ware with its own individual characteristics—the famous Delft-Blue, which in turn was copied.

The invention of the art of making real porcelain by Böttcher in Europe and Josiah Wedgwood's invention of china-ware in England, however, dealt a severe blow to the Dutch pottery industry. In efforts to compete, the Dutch lowered the prices—and the quality—of their wares with disastrous results. Only one firm survived—"De Porceleyne Fles." After a very poor existence for many years this concern was taken over by Joost Thooft in 1875, who, together with his partner, Abel Labouchere, laid plans for a revival of the industry. They succeeded and today their wares are exported all over the world.

New Techniques and Designs

This regeneration involved new production techniques and the development of numerous new designs. Capable artists were brought into the firm, and there grew up a staff of skilled designers and painters, who have done much to ensure the success of the modern blue Delft-ware produced at this factory.

Although "De Porcelyne Fles" is the only surviving original firm making Delft-Blue, many other firms in Holland began to make this well-known type of pottery and much of their work is exported. Products consist in the main of vases, plates, jugs, lampstands, brooches, and a wide range of souvenir articles. Wall tiles have long been a speciality in Delftware. These, and allied materials for architectural use, because of their generally recognised aesthetic qualities, occupy a prominent place in many present-day buildings.

Delft-Blue is also now being used as decorated containers for high-class Dutch products such as liqueurs and geneva. This is quite a recent idea, and is the result of a working arrangement between the potter and distiller.

Gouda

The pottery centre of Gouda also has a long history, having occupied an important place in the manufacture of ceramics in the Middle Ages. For instance, about 400 years ago there were thirty-five potteries of considerable size in the town. Here, also, there have been times of booms and depression, and the character of the industry developed into one chiefly of luxury pottery. The colourful Gouda faience is still being placed on the market in a variety of shapes and rich colourings. In addition fine Gouda services find a good sale both in the Netherlands and abroad.

One of the outstanding features for which Gouda is well known is the clay pipe, which has been made there for centuries. Although the clay pipe has now been largely displaced, there are still a few pipe kilns at Gouda which turn out the famed "Gouwenaar" long-stemmed churchwarden. Shorter models, such as the "Baronites" and coloured clay pipes, often amusingly decorated, are still in fairly considerable use.

Makkum

In the province of Friesland, the availability of suitable clays gave rise, again a long time ago, to a local pottery industry in the western districts. Today, Makkum is the only remaining centre of importance. Even here, apart from some of the work having been put on to machines, there has been little change in methods over the

Bowl, wall plate, ashtray, cow and covered jar in Blue Delft ware. Made by De Porceleyne Fles

years. At present, household and decorative wares are being produced.

Decorative tiles are also a feature of the Makkum industry and have considerable repute for use in Dutch interior decoration. Their popular use is in facing old chimney mantles. Tiled fireplaces of this kind, with Biblical and other scenes or landscapes, are highly thought of in Holland and usually display fine colours.

Limburg

Very large potteries are also to be found in the southern part of the province of Limburg, especially in the city of Maastricht. The industry in this area is more recent in origin, but has expanded greatly in recent years and now far exceeds all the older traditional centres of pottery manufacture. The district concentrates chiefly on utility ware, and the Maastricht potteries supply a wide range of domestic china-ware though an appreciable quantity of decorative ware designed by leading artists, and also sanitary ware, is made.

The village of Telegen in North Limburg is also noted for its decorative ware. The making of pottery here was due to the availability in the district of a number of clays, each of which fired to a different colour.

Competition in the field of household china-ware generally, in Holland has been responsible for considerably improved taste in these products and they are now usually of good quality. So far, however, their sale is, for the most part, confined to the home market.

Holland has an extensive and traditional trade with the Far East—it was porcelain from the East that gave impetus to her early Delft-ware industry—and she does a considerable re-export trade in certain products. Included among these are tea and coffee cups and saucers which are decorated with striking and varied Oriental and European designs. Another item in this category is the re-export of egg-cups decorated in many unusual ways, as for instance with the added figures of animals, the cup part often representing articles

such as baskets, small carts, etc.

Today, there are a number of forces working in Holland toward even greater improvement, efficiency and better design and artistry in the Dutch industry. Among these, two of the most outstanding might be mentioned, namely: the Ceramic Institute T.N.O. and the Dutch Federation of Applied Arts.

Scientific and Technical Guidance

The task of the Keramisch Instituut T.N.O. (to give it its Dutch title), which is domiciled at Gouda, consists of giving scientific and technical guidance to the Dutch ceramic industry over the whole range of its products. This is done, for example, by studying problems which are of interest in the field of both fine and coarse ceramics. It not only passes on the outcome of its research to the ceramic factories, but it also tackles individual problems for the industry. It investigates raw materials, the composition of the clay, processes of manufacture and the drying, baking and glazing of the products. In addition to this the Institute makes fundamental research into the component parts of the clay itself, processes, systems of drying, types of kilns, mechanical equipment for the factories. Chemical and physical investigation, as for instance by X-ray, are undertaken. All work undertaken for the trade is done in the strictest confidence.

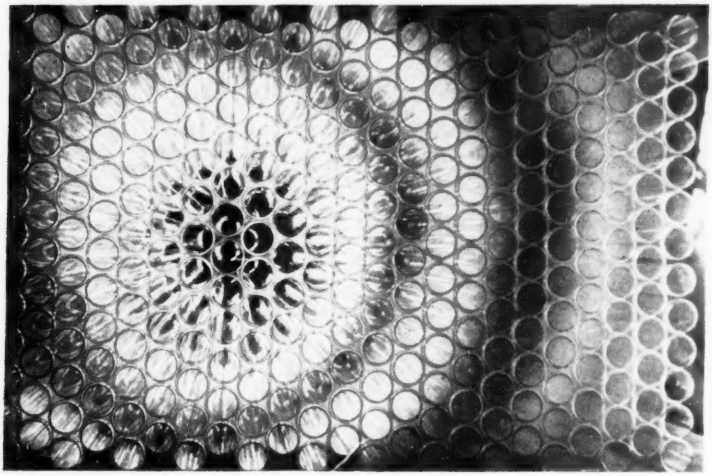
The Netherlands Federation of Applied Arts aims at combining artistic and the functional qualities in the manufacture of modern household and industrial goods. It has a ceramic department, which studies designs and colours in relation to the new conception that household pottery, including both decorative and utility ware, should be in harmony with their surroundings and have genuine functional use.

The Federation arranges exhibitions and has a stand at the Utrecht International Fairs held during the spring and autumn. At the 1951 autumn fair, for instance, there was a stand showing hand-thrown products of the pottery industry made from special clays and with special glazings. Baked under very high temperatures these had hardened so as to be almost equal to china-ware. Among the pieces displayed was a dinner service in bluish-black with a pure white inside, also ornamental articles decorated with floral designs in deep maroon, turquoise and red. Interest in this type of pottery was shown particularly from countries where machine-made mass-produced earthenware or

Hand-made and hand-painted "Royal Blue" pottery, with gold-lustre decoration

soft hand-made pottery is used, and considerable orders were received from such neighbouring countries as Belgium and France, though orders were also placed by important houses in the United States, Canada, Central America, the Argentine, South Africa and Australia.

Efforts are being made by the government and the "Vereeniging Tot Veredeling Van Het Ambacht" (Society for the Improvement of Arts and Crafts) to attract youth into the various skilled crafts including the pottery industry. It is felt that too many youngsters are drifting into "white collar" work, and training and apprenticeship schemes have been evolved, though with rather unsatisfactory results so far.



Five minutes' production of tubes

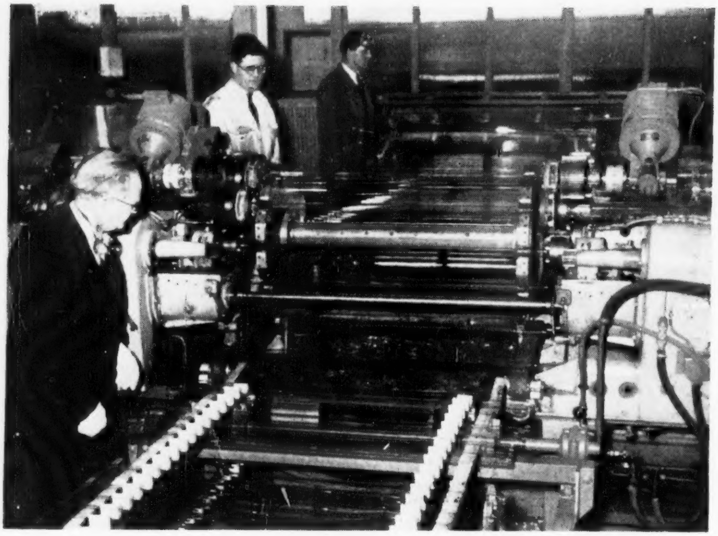
New Glass Tube Plant

THE Rt. Hon. James Stuart, P.C., M.V.O., M.C., M.P., Secretary of State for Scotland, opened Chance Bros. Vello Tubing Plant at Firhill, Glasgow on 16th January, 1952.

The new plant is a quarter-of-a-million pound dollar-earning and dollar-saving project which will make Britain self-supporting in glass tubes for fluorescent lighting. Up to now, not enough tubes for this purpose have been produced, resulting in imports, mainly from America. The output from the new plant will more than fill the gap, so that export markets can be fed as well.

The plant is quite unique. The principles on which the Vello process is based were conceived in France and developed in America by the Corning Glass Works. The installation of the plant in Glasgow has been achieved by co-operation between British and American glassworkers and engineers.

Although most of the original designs for the process machinery were American they have been adapted by the engineering staff of Chance Bros., who also designed the furnace which makes the glass. All the machinery was made by British firms and some of it was designed and constructed by Chance Bros.' engineering department.



End-forming of tubes by fully automatic machinery by Dominion Engineering Co. Ltd.

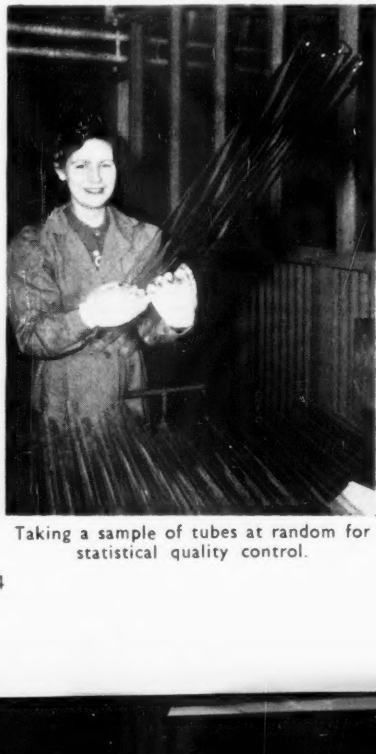
The new plant is fully automatic. The glass is made in a furnace capable of producing 250 tons a week. From the furnace glass flows through a channel some 24 ft. long, where it is automatically controlled to pre-determined temperatures. This ensures that the glass is forwarded to the tube drawing mechanism in the correct condition.

The hot glass then passes through a metal annulus consisting of an inner funnel known as the "bell" and an outer cylinder known as the "ring." Air is blown down a hollow shaft through the bell to inflate the glass and to keep it in tubular form.

At this stage, the diameter is considerably greater than is required in the finished article. The glass tube, still soft, initially falls vertically. The moving tube is stretched so that its diameter continues to reduce without distortion of the circular section, and at the same time it is turned through a curve (called the catenary) into a horizontal position, the complete change being accomplished in about 20 ft.

The glass then moves over its horizontal runway as a continuous tube until it is cut into the required lengths by a "hot-cut" machine, which first heats a narrow band of glass and then severs it by chilling.

Each tube then falls on to a conveyor belt and moves through a machine which automatically measures its diameter and rejects any tube of incorrect dimensions.



Taking a sample of tubes at random for statistical quality control.

The tubes are then raised to the processing floor, where the ends are cut to precise lengths and smoothed in a flame. Where required a special machine automatically shapes both ends of the tube. The tubes are then packed in cartons, in which they are supplied to the customer.

Because of the high rate of production of the plant statistical quality control methods are used at various stages to ensure that the end product is kept within the necessary close tolerances.

The special advantages of the Vello process over other methods of drawing tubes of glass are the greater speed of production and the closer tolerances that can be achieved. The plant is capable of producing one tube every sec., equivalent to about 3½ miles of tubing per hour.

The plant works continuously day and night for many months, without the need for a shut-down.

Chance Bros. have had active support from Government departments and nationalised industries in this project. Since a considerable quantity of towns gas is used, the Scottish Gas Board have put in a new 8 in. gas main nearly a mile long, and the transport authorities have organised a special trunk service of vans to take the tubes direct from Firhill, to lamp manufacturers over the length and breadth of Great Britain.

THERMAL ANALYSIS

RESEARCH SERIES No. 21, November, 1951, is a bibliography of differential thermal analysis compiled by W. J. Smothers, Yoa Chiang and Allan Wilson, and published by the University of Arkansas, Institute of Science and Technology, Fayetteville, U.S.A.

It was compiled to facilitate the identification of relatively unknown substances which often are present in materials subjected to differential thermal analysis, and consists of four parts. The first presents a brief description and history of the method of differential thermal analysis. The second is a chronologically arranged bibliography of technical papers in which the use of the method of differential thermal analysis was reported. The third is an index of authors. The last part is an index of materials which have been analysed by the differential thermal method.

There are 165 references covering the subject up to 1950.

MODERN BOILER DESIGN

by

VERNON WALKER, A.M.I.E.E.

THE most outstanding features of modern boiler design are the increased capacity, the increase in water-cooled surfaces and the provision of large combustion chambers.

The earlier design of combustion chamber had a small space lined with refractory. Water-cooled surfaces were first installed with the object of reducing maintenance of the refractories and increasing availability, and in the case of pulverised fuel fixed boilers to form a screen for the purpose of cooling the ash and preventing slagging. It was soon apparent that the value of furnace heating surfaces for absorbing radiant heat was an important one, and modern units now absorb 40-50 per cent. of the total heat transfer in the furnace walls.

With large steam generating units the present tendency is to have a comparative low heat release in the combustion chamber of between 20-30,000 B.Th.U. per c. ft. of furnace volume in order to obtain a high availability by reducing maintenance and slagging of the furnace and boiler tubes. With high steam pressures in conjunction with high steam temperatures the percentage of heat transmitted from the flue gases to the superheater has increased to a considerable extent, and at a pressure of say 1,200 lb. sq. in. 935° F. steam temperature the heat required is three times that required for steam at 200 lb. sq. in. 570° F.

Modern designs are therefore characterised by considerable increased superheater heating surface arranged in a zone of high temperature with facilities for controlling the final steam temperature.

The superheater has therefore been brought nearer the furnace to obtain the necessary steam temperature, and this has had the effect of reducing the boiler heating surface in order to obtain the required steam temperature.

With high final steam temperatures of 925-975° F. associated with the 900 lb. sq. in. 900° F. at the turbine stop valve the steam temperature is required to be maintained within narrow limits over a wide range of load, the temperature of the gases leaving the furnace being sufficiently low in relation to the softening and fusion temperature of the ash that slagging of the water walls and boiler surface is minimised. On the other hand a high degree of superheat requires an adequate temperature gradient between gases and steam for an economical provision of superheater surface, the gas entering the superheater may be as high as 1,800°-1,900° F. This means that at high ratings the superheat may be excessive.

Methods of Control

Typical methods of control are: (1) The gases are by-passed across the superheater or part of the superheater when steam temperature is high; (2) A desuperheater is interposed between a primary and secondary section of the superheater, a varying amount of steam passing through the desuperheater. The desuperheater may be of the surface or spray type. In the surface type a proportion of steam from the primary superheater is passed through cooling tubes partially immersed in water at saturation temperature, circulated from the boiler drums in a separate pressure vessel, a by-pass valve regulating the amount of steam entering the desuperheater element. In the spray type a spray of water is injected into the steam flow; (3) With pulverised fuel boilers fired by the tangential system, the burners are made to change their angle, thus obtaining some control, depending on

whether the flames are deflected upward or downward in the combustion chamber; (4) By combining a radiant and convection type superheater in series. On an increase or decrease in load the radiant and convection superheaters have opposite characteristics and a wide range of control is obtained.

Temperature of Superheater Elements

The metal temperature of the superheater elements does not normally exceed the steam temperature by more than 50°-75° F. as the tube is cooled by the steam which flows through them.

Providing that the steam temperature does not exceed 850° F., metal temperature 925° F., mild steel is suitable for superheater tubes. Above this temperature special steels containing molybdenum, chromium and nickel are used.

Adequate strength is retained by ordinary mild steel up to the above temperature, above this there is a serious reduction in the strength of the metal.

When steam temperatures do not exceed 700° F. a variation of 50° F. up or down as a result of changes in operation are not of grave importance, but such variation cannot be allowed to take place when using steam at 900° F. and over. The strength of the alloy steels is reduced rapidly as temperature increases, an increase of 20° F. on the working temperature of 900° F. carried for several hours may reduce the life of the elements by several years.

Fuel Combustion Characteristics

The combustion characteristics of the fuel must also be taken into account in furnace design since a low volatile content fuel may set a limit to the extent to which the walls may be cooled if excessive carbon in ash, loss and poor stability of combustion at light loads are to be avoided. Certain dimensions may also limit the space required for the burners and for the necessity of providing sufficient flame travel so that combustion may be complete before the gases reach the boiler convection banks.

Slag control becomes increasingly more difficult as the capacity and size of the unit is increased. Increases in steam generator capacity are usually anticipated in the design by proportional increase in furnace volume. Actually as the unit size increases, all other conditions being the same, furnace volume should be increased more than in direct proportion if the same furnace exit gas temperature and freedom from slagging of the boiler and superheater is desired.

Furnace Size and Temperature

As the furnace size is increased the area of wall, roof and floor space per c. ft. of furnace volume available for coverage with heat absorbing surface decreases rapidly. Thus in a furnace that has 10 ft. of water-cooled furnace on five sides, the area of wall surface is 500 sq. ft. for 1,000 c. ft. of volume or a ratio of 1:2. In a furnace that is 20 ft., the surface becomes 2,000 sq. ft. for 8,000 c. ft. volume or a ratio of 1:4. At a constant heat release the furnace exit temperature therefore rises as the furnace size is increased. The exit temperature can be controlled by either reducing the heat release as the capacity is increased, or by increasing the radiant heating surface installed per c. ft. of furnace volume. There is a tendency in modern practice to depart from the furnace of cubical shape to vertical elongated type, whereby an increasing ratio of surface to volume is provided, thus correcting the gas temperature to the desired limits.

Furnaces therefore tend to become longer and the walls to become farther and farther away from the burning gas stream. This makes cooling of the gas stream more difficult. One latest American design for a large pulverised fuel boiler introduces a solid bank of tubes down the middle of the furnace dividing the latter into two compartments and bringing the wall tube surface closer to the burning gas streams.

The reduced heat consumption of the turbine which the designer has derived from a high degree of feed heating has considerably increased the feed water temperature entering the economiser. This means that the flow of gas across the superheater is reduced as the coal burnt for a given output decreases, so that the steam temperature can only be maintained by increasing the surface of the super-

heater or decreasing the boiler surface ahead of the superheater, or a combination of both.

In order to keep the economiser heating surface within reasonable limits the gas temperature leaving the economiser is usually kept at least 140°-180° F. above the incoming feed temperature. A lower temperature difference means an excessive amount of heating surface in the economiser. Water at higher temperature may therefore mean that a higher gradient becomes necessary in both the boiler and economiser with an increase in the air heater surface.

In a stoker-fired unit the furnace is generally smaller than in pulverised fuel-fired boilers, and this means a larger boiler convection bank will be installed at the furnace outlet to obtain the same gas temperature at the inlet to the superheater. The amount of heating surface in the air heater will be smaller than that of a pulverised fuel-fired unit, the air temperature is generally limited to between 250°-350° F. or stoker maintenance becomes excessive. In order to compensate for this the economiser surface may be increased and the difference between economiser exit gas temperature and feed water inlet reduced.

When using very wet coals with pulverised fuel an air temperature as high as 600° F. is required at the pulveriser to dry the coal and it may be difficult to design the air heater economically with the usual stack temperature. The difference between the air leaving and the entering gas is not generally less than 80°-100° F. and this sets a maximum limit to the air temperature with a given exit gas temperature.

To overcome this and obtain a more effective temperature difference between gas and air, a special separate primary air heater is employed in conjunction with a separate secondary air heater and a non-steaming and steaming economiser. The non-steaming economiser is placed between the secondary and primary air heaters. The gases then pass from the boiler over the steaming economiser through the secondary air heater, through the non-steaming economiser and finally through the low temperature section of the air heater. In some cases where the moisture in the coal is not normally high the air heater is designed for a normal temperature and the economiser arranged to be by-passed to raise the gas temperature entering the air heater when unusually wet coals are in use. In other instances the higher air temperature is obtained by designing the air heater for a higher final gas temperature.

Tubular air heaters have been divided into two sections so that the cold end contains tubes of short lengths which can easily be replaced. These are made of aluminium or stainless steel to reduce corrosion troubles.

Rapid Increase in Size

During the last 30 years the capacity of boilers in British power stations has been increased tenfold. There are now a number of boilers having a capacity of 500,000 lb./hr. and the future programme for 1952 includes twelve boilers of this capacity. The rapid increase in size has been impelled by the desire to simplify plant design, so that one boiler, one set of piping, one set of auxiliaries and one set of controls, serve the same unit. Such simplification has also led to lower first costs. The weight of a boiler unit per ton of steam evaporated is reduced considerably as the capacity is raised, a 800,000 lb. per hour boiler on this basis being reduced by 50 per cent. against a 30,000 lb. per hour boiler. The single boiler, single turbine arrangement is particularly well suited to re-superheating systems where the steam, after passing through the high pressure stages of the turbine is led to the boiler superheater and raised to the initial temperature before passing to the low pressure stages of the turbine. The problems involved in the design of large units to provide for expansion support and structional strength are complicated, and the fabrication of the large drums of 50 in. to 60 in. and 40 ft. long requires great skill. Boiler circulation problems have been solved to such an extent that the circulation through the large number of furnace tubes and the downcomers capacity of the cooler water lines outside the boiler is such that blistering or burning of furnace wall tubes is becoming rare, even with heat absorption as high as 100,000 B.Th.U. sq. ft./hr.

Boiler designers have always had to consider the problem of replacing boiler and superheater tubes, space being allowed in the boiler house so that the tube could be withdrawn and a damaged tube replaced. This is often a difficult job when replacing a furnace tube. Welding repairs are now being developed, especially in American practice, so that the damaged section of a boiler or superheater tube may be cut out and a new piece welded in its place. This is, of course, much simpler than pulling out the whole tube and the designer has to consider only the initial erection, and is not concerned with openings and clearances for tube renewal. In many cases superheater and economiser tubes are welded to stub tubes, welded to the drums or headers, thus avoiding expanding tubes on site.

One of the reasons for good ignition in pulverised fuel furnaces, even in those having completely bare walls and using wet fuel, is the high air temperature supplied to the pulveriser. It has been found that with good mixing of the coal and air at the burner, combustion is very rapid and complete, and the danger of surges or loss of flame or furnace puffs has, to a large extent, been eliminated. Good pulverisation must be maintained over a wide range of load and is essential for quick ignition and for avoiding sticky particles of ash being carried into the boiler passes, thus avoiding heavy deposits on the heating surfaces.

The development of steam scrubbers has made possible the thorough removal of water from the steam and has resulted not only in less carry-over but has permitted the number of boiler drums to be reduced.

Soot Blowers

Although in some cases it has been found possible to dispense with soot blowers in economiser sections due to the development of better cleaning methods both "on" and "off" load, soot blowers are still an important adjunct. These have been greatly improved in recent years by mass blowing. In American practice the use of steam or air on a puff system with automatic sequential push button control has been simplified and improved, performance of soot blowers has assured clean heating surfaces.

Wider spacing of the first pass boiler tubes and superheater tubes has resulted in the gas velocity being reduced while still at a high temperature, which has resulted in the ash adhesion as well as erosion being reduced. Velocity of 50-100 ft./sec. have been reduced to 25 ft./sec.

Another American development is the pressurised furnace which aims at the elimination of the induced draught fan with its problems of space, power, maintenance and cost. The pressure furnace it is thought would be particularly promising in connection with outdoor and semi-outdoor boiler installations, of which there are a number in the States, where the escape of gases through the setting would not be a handicap to operation. The outdoor or semi-outdoor installation not only reduces building costs but makes the boiler house a more comfortable place to work in, as the surfaces radiating heat are placed outside.

(Courtesy, "Cheap Steam.")

BUILDING RESEARCH CONGRESS, 1951

BOOKS containing the papers presented in the three divisions of the Congress are obtainable, price 22s. 6d. each or 50s. for the set of three, from the Organising Secretary, Building Research Congress, 1951, Building Research Station, Garston, Watford, Herts. Members of the participating bodies of the congress may obtain single books at 17s. 6d. each.

The Division 1 book contains papers on building techniques, structural matters, and soil mechanics. Division 2 contains papers on building materials. Division 3 deals with acoustics, heating and ventilating, lighting, and with problems of hospitals, factories and schools.

The three books together present an up-to-date picture of the present position.

The record of discussion which took place at the technical sessions of the Congress may be ordered now in advance of publication, price 25s. (20s. to Congress members).

L. O'Connor.—Mr. Leslie O'Connor, C.B.E., has been appointed director-general of carbonisation, National Coal Board, and will be responsible to the Board for the production of carbonised and other processed fuels.

The Controlled Milling of Ceramic Materials

by

H. L. PODMORE, B.Sc., F.R.I.C.

THE properties of ground ceramic materials depend to a considerable degree upon the specific surface and the distribution of particle size. It is imperative, therefore, that such materials be ground in accordance with the requirements of the users and that uniformity of product be maintained in successive deliveries. With the almost daily increase in power costs it is also of the utmost importance that grinding be carried out as efficiently as possible. In view of these requirements and the complicated nature of the process, the grinding of ceramic materials demands the strictest control.

Closed and Open Circuit Grinding

Fundamentally there are two ways in which grinding can be controlled. The processing can be carried out in closed circuit in which case the control is provided mainly by a classifier, or a mill in open circuit may be used in which case the control must be applied principally during the grinding process. This paper is confined to the provision of control in open circuit grinding, such as for batch grinding on a ball mill.

Theory of Grinding

The mechanism of grinding is very complex, but an understanding of the fundamentals is essential before methods of control can be considered.

The energy used by an electric motor in driving a ball mill through a reduction gear is dissipated in the following ways:

1. Heat losses associated with the electric motor, the reduction gear and main bearings of the cylinder.
2. Heat losses arising from work done inside the cylinder.
3. Work done in grinding and modifying the product.
4. Work done in grinding and modifying the grinding medium.

The heat losses under (1) will in practice be approximately 25 per cent. of the energy used. According to Schellinger who has studied mill efficiencies calorimetrically, the sum of (3) and (4) does not exceed 15 per cent. and the remaining 60 per cent. of the input energy is dissipated as heat from the ball mill. Of the 15 per cent. of input energy used in grinding and modifying the product and grinding media, it would seem that the actual energy used in grinding, i.e. breaking apart the ionic links, is less than 0·5 per cent. of the input energy. It will be realised, therefore, that at its best grinding is an exceptionally inefficient process and in consequence attempts to obtain absolute values for grinding efficiency of mills and the resistance to grinding of materials have met with little success.

When a particle is broken the energy used is proportional to the area sheared, i.e. to the new surface produced. It would be expected, therefore, that providing the mill efficiency remains constant then the increase in specific surface, would be proportional to the input energy of the mill. This relationship (Rittinger's Law) is found to hold in general for fine grinding within the limits applicable to ceramic materials.

Grinding Efficiencies

Assuming that the aim in grinding is to produce a required surface on a

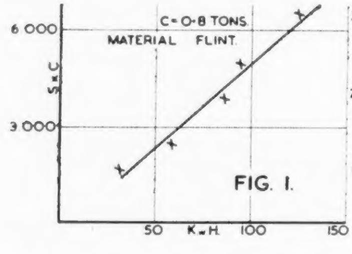
given weight of material with the least expenditure of energy then grinding efficiency may be expressed as:

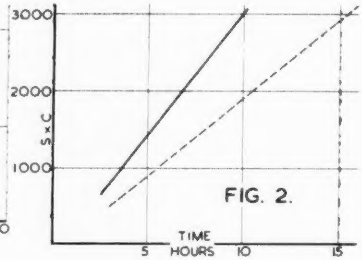
$$\frac{(S_2 - S_1)C}{K.w.H.}$$

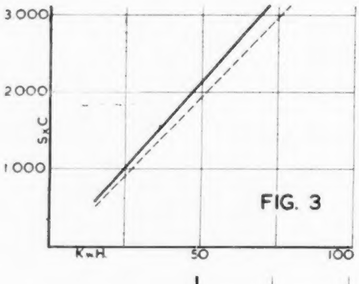
Where S_1 is the original and S_2 is the final specific surface in $cm^2/g.$, C is the weight of the charge in tons and K.w.H. is the energy input in Kilowatt hours. If K.w.H. is the energy supplied to the prime mover then the efficiency figure obtained is the "overall efficiency." If on the other hand K.w.H. represents the energy actually imparted to the mill, i.e. as measured by a dynamometer, then the result obtained is the "mill efficiency."

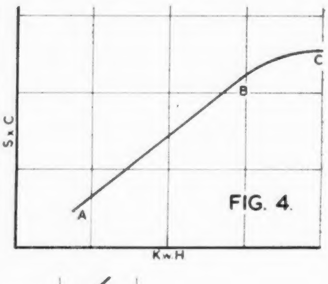
In practice it is generally sufficient to be able to determine the overall efficiency of a mill, but it should be realised that if the mill efficiency is constant but the rate of grinding be changed, then the overall efficiency will be changed. Other things being equal it follows, therefore, that the higher the rate of grinding, the higher will be the overall efficiency.

If at successive intervals of grinding the specific surface of the product be determined and the corresponding









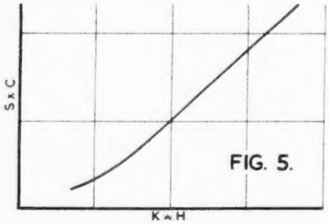


Fig. 1. Relationship between input energy (K.w.H.) and the product of specific surface and weight of charge. Fig. 2. Rates of grinding of similar charges but with different viscosities. Fig. 3. Mill efficiency lines for the grinding as in Fig. 2. Fig. 4. Relationship between K.w.H. and (S×C) and departure from linearity for very finely ground material. Fig. 5. Efficiency curve for material which in comparison with the size of the grinding pebbles has not been sufficiently reduced in size before grinding, i.e. the material has not been sufficiently crushed

values noted for consumption of electrical energy in Kilowatt hours, then on plotting the product of specific surface and weight of charge against the energy used by the mill, a graph of the type shown in Fig. 1 is obtained.

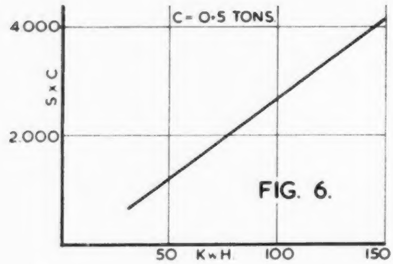
The relationship is linear as would be expected from Rittinger's Law and the tangent of the angle of inclination of the line represents the efficiency of the mill for the particular loading and material being processed.

It will be appreciated that by varying the mill loading for a given material and determining the corresponding efficiency values, the optimum conditions for efficiency can readily be found. Furthermore, if an efficiency line is obtained for a particular material and mill loading then providing the same conditions are maintained on future occasions the fineness of the material at any stage of the grinding can be ascertained by reference to the reading on a watt hour meter.

In practice it is found that for different conditions of loading the rate at which grinding proceeds varies over a very wide range, while the mill efficiency is not nearly so critical. If, therefore, the efficiency of the mill is not known it is still far better to control grinding by reference to the energy used rather than by the usual method of grinding for a given time. In fact, a 50 per cent. error in fineness can readily be obtained in successive charges ground for the same period of time and under loading conditions as nearly identical as normally exist under practical conditions.

In Fig. 2 the processing indicated by the dotted line has taken twice as long as that represented by the continuous line to reach a given specific surface. The corresponding mill efficiency lines shown in Fig. 3 almost coincide.

If an efficiency line be prepared for a very finely ground material a point will be found at which the rate of increase in surface to energy used begins to decrease and eventually the increase in surface equivalent to a given unit of energy may approach zero (Fig. 4).



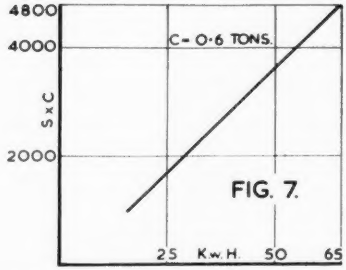


Fig. 6. Mill efficiency line for felspar. Fig. 7. Calculated efficiency line for Borocalcite

The explanation of the phenomenon appears to be not that grinding ceases at the point (B), but due to the disparity in size between the particles of the product and those of the grinding medium, the medium begins to grind away more rapidly. As grinding proceeds beyond the point (B) towards (C) the pint weight of the charge increases perceptibly due to the inclusion of the finely ground grinding media.

At the commencement of grinding it will often be found that the efficiency is lower than for the grinding as a whole (Fig. 5). This would appear to be mainly due to the size ratio of the grinding medium to product being insufficient. If the material being processed is crushed more finely before being charged into the mill it will be found in general that the efficiency at the commencement of grinding will closely approximate to the normal efficiency.

It should be noted that these efficiency curves relate to specific materials due to the fact that the rate of grinding depends upon both the efficiency of the mill and the resistance to grinding of the particular material.

Resistance to Grinding

Attempts have been made to compare the resistance to grinding of various materials by comparing the grinding rates on "standard mills." Quite apart from the difficulty in standardising grinding conditions, such a technique is unreliable due to variation in mill loading resulting from differences in the specific gravity of materials.

A simple yet accurate method of comparing grinding resistances has been developed in the Podmore laboratories. In this method the resistance to grinding of the various materials is determined with regard to limestone as a standard. Suppose that we wish to compare the resistance to grinding of two samples of felspar "A" and "B"; the procedure is then as follows:

Determine the specific surface of a sample of partly ground felspar "A" and also that of the partly ground standard limestone. Mix the two materials in equal proportions by volume and charge into a ball mill. Grind for a suitable period of time and then determine the specific surface of the mixture. Place the mixture in dilute hydrochloric acid to remove the limestone and determine the specific surface of the remaining felspar. From the figures obtained the increase in surface on the limestone can be compared with that on the felspar under identical conditions of grinding. The experiment is then repeated with felspar "B" so enabling its grinding resistance to be compared with that of felspar "A." The resistance to grinding of limestone has been arbitrarily fixed at 1. If, therefore, material develops twice as much surface as the limestone under the conditions of the test then its resistance to grinding is 0·5.

It is sometimes found that if a fine material is ground together with a coarser material the rate of grinding of the latter is impeded. To eliminate errors in the test due to this effect the mean diameters of the two materials

should be similar. Further, if the material has an appreciably higher grinding resistance than limestone then the specific surface of the limestone should initially be lower than that of the other material and finally it should be higher by the same amount as it was deficient initially.

If the two materials being ground together have different specific gravities then when calculating the final specific surfaces of the materials constituting the mixture due allowance should be made for the differences in the proportion by weight of the mixture.

Summary and Practical Examples

Suppose that we wish to grind a quantity of borocalcite (S.G. 3·0) to a specific surface of 8,000 cm^2/g., and that no previous grinding experience had been obtained for this material but that an optimum mill efficiency line had been obtained on the particular ball mill for felspar (Fig. 6).

If the optimum charge for felspar (S.G. 2·5) is 0·5 tons then the nominal charge for borocalcite is $\frac{0{\cdot}5 \times 3}{2{\cdot}5} =$ 0·6 tons. Suppose that the ratio of resistance to grinding is found to be felspar : borocalcite = 2·2 : 1, then an efficiency line for borocalcite can be prepared by dividing the values for K.w.H. in Fig. 6 by 2·2 (Fig. 7).

The product of charge and required specific surface for the frit is $0{\cdot}6 \times 8{,}000 = 4{,}800$ for which the corresponding value of K.w.H. from the graph is 65, that is, if 0·6 tons of borocalcite is charged into the cylinder, water added, and then ground until the input energy for the mill reaches 65 K.w.H. then the specific surface will be found to be approximately 8,000 cm^2/g. Should it be required to grind to other finenesses the corresponding values for K.w.H. can readily be obtained from the graph.

It should be noted that the calculated efficiency line is not necessarily the optimum efficiency. The efficiency will, of course, depend upon the viscosity and in order to obtain the optimum overall efficiency it will be necessary to make adjustments to the solid : water ratio and by trial and error deduce the conditions for optimum efficiency.

The addition of a small quantity of a deflocculent will in general increase the overall efficiency by reducing the viscosity for a given solid : water content.

ANCHOR POTTERY

In Ceramics, December, 1951, page 504, there was a photograph of a modern slip house, showing a tank and weighing machine, used for controlling the pint weight of the materials by the volume-weight method, published by courtesy of Service (Engineers) Ltd. This slip house in installed at the Anchor Pottery of Sampson, Bridgewood and Sons Ltd., Longton, Stoke-on-Trent.

Glassmaking Approaches Fully Automatic Production

THE feeding of charges of molten glass to forming machines was formerly a hand operation. Automatic feeding was accomplished after much experimentation and hard work, and was put into general commercial operation in the period 1915-1920. There have been many improvements in equipment and technique in recent years.

A modern gob feeder is shown in Fig. 1. It will be seen that the feeder is a combination of refractory parts and mechanical devices. It is really an integral part of the fore-hearth which again emphasises the continuity of the glassmaking process. Commonly, the feeder is considered to consist of the feeder bowl, mechanism, shears, and the adjoining 4 ft. conditioning section.

The feeding cycle is timed to the speed of the forming machine and is adjustable in phase. The speed is adjustable over a wide range according to the demands of the forming process from three to 128 per min.

If the glassmaking operations are carefully controlled the operation of the feeder is a comparatively simple procedure, and, once it is set, requires

Part of a lecture delivered at the American Gas Association Industrial Gas School, Pittsburg, by Aaron K. Lyle, chief chemical engineer Hartford Empire Co., and published by courtesy of *Industrial Gas* (U.S.A.).

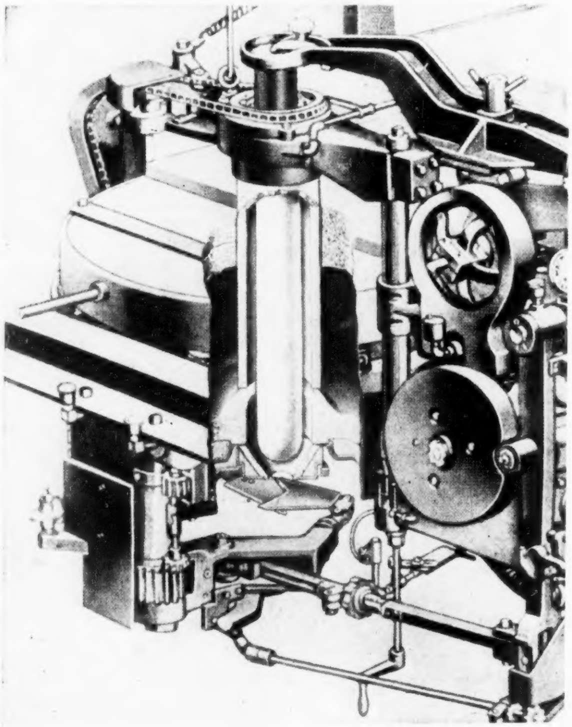


Fig. 1. A modern gob feeder

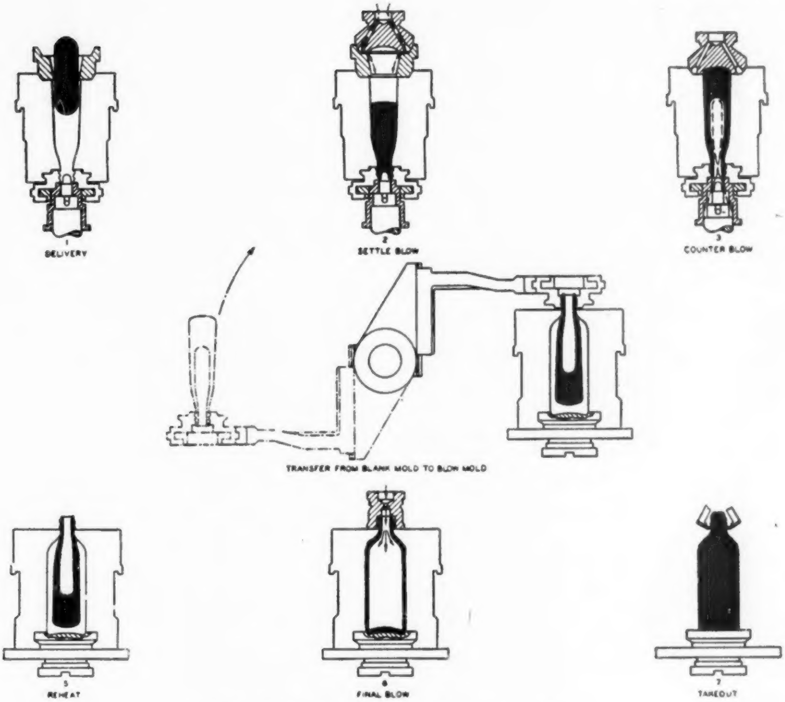


Fig. 2. Diagram of I.S. forming cycle

very little adjustment. However, variation in batch materials, batch charging, and furnace temperatures affect the operation to feeders so as to require constant attention and adjustment. Glass that is about to be fed to a forming machine is very sensitive to small changes in composition, homogeneity, and temperature, all of which are important in maintaining the desired viscosity. Up to this point in the process, viscosity is of relatively minor importance, but beginning with feeding, and continuing through forming and annealing, viscosity determines production.

Forming Processes

Forming processes are simple when described in terms of general principles, but are extremely complicated when studied in detail. Stated simply, the process of forming glass consists of shaping it by pressing or blowing, or a combination of the two, while at the same time extracting heat to increase the viscosity of the glass, until the formed shape is set and self-supporting. It is during this process, which is usually completed in a very few seconds, that the glass undergoes its greatest change in viscosity.

Fig. 2 illustrates the forming cycle employed by the I.S. machine. (The term I.S. indicates individual section which refers to the construction of the machine to combine one, two, four, or five individual sections. By use of dual equipment, each section may be made to produce two pieces of ware at each cycle thus almost doubling the output. The five-section machine is the one in most common use.)

The process illustrated is known as blow-and-blow. Diagram 1 shows a gob of glass entering the blank or parison mould. As soon as the gob is within the mould, a blow head covers the funnel, and, by air pressure, forces the glass into the details of the finish or mouth of the bottle being formed, Diagram 2. The plunger is

withdrawn, the funnel and blow head are removed, and the blow head, now a baffle plate, is returned to complete the mould, and air is admitted to expand the parison, Diagram 3. In Diagram 4 is shown the inversion of the parison to the final or blow mould. The parison is released from the neck ring, Diagram 5, and the final blow is applied to complete the forming operation as shown in Diagram 6. The finished bottle is removed by automatic take-out tongs, Diagram 7.

The press-and-blow process is similar, differing only in that a plunger, instead of air, is used to form the cavity of the parison. The press-and-blow process is used in forming of wide-mouth ware.

The Temperature Gradient

The actual forming operations require a very small portion of the time required to make a piece of ware. Most of the 5-15 sec. total cycle is required for extracting heat and allowing time for partial equalisation of temperatures within the glass. The temperature gradient near the surface of the glass in contact with the mould is very great, amounting to 500° F. or more for a thickness of $\frac{1}{8}$ in. When the parison mould is removed the surface glass is reheated by the hotter interior glass so as to permit final blowing to shape.

There is very little information available on the thermal conductivity of glass, but it is almost as important as viscosity in the forming process. At low temperatures, glass is a very poor conductor of heat, but as the temperature is increased, its conductivity increases very rapidly. Thus by chilling the surface of molten glass it is possible actually to retard loss of heat from the interior. The chilled surface forms an insulating layer. Except for this property of glass it would not be possible to use moulds at relatively low temperatures in the forming process, and hand forming would be almost impossible.

When ware leaves the forming machine it is still soft enough to be easily deformed, and, unless cooling wind is applied, the ware will usually slump. At this stage of the forming process glass is very vulnerable and must be protected against sudden localised cooling. All metal or other material of conveyors or tongs must be nearly the same temperature as the glass and must be free of grease and oil. Sudden chilling will cause tiny cracks, called checks, to persist in the final product. The occurrence of these tiny cracks is the greatest single cause of lost production. There is a very fine balance between ware having checks and ware being deformed and in maintaining this balance the machine operator must exercise his greatest skill.

From the forming machine ware is carried on a continuous belt conveyor to the annealing oven or lehr. Transfer from the conveyor to the continuous wire-mesh belt of the lehr may be accomplished by one of several automatic devices known as lehr loaders or stackers.

The Electrical Properties of Oxide Mixtures as an Index of Structural and Phase Changes at High Temperatures

THE following is a summary of *Research Paper* No. 17, 1948, by W. F. Ford and J. White, which has been reprinted by permission of the Council of the British Ceramic Research Association, in the *Transactions of the British Ceramic Society*, Vol. 51, No. 1, January, 1952:

Refractory oxide mixtures at high temperatures exhibit an electrical conductivity which is duplex in nature, part being attributable to ionic conductance and part to absorption conductance arising from the presence of relaxing units.

A summary of the fundamental knowledge relating to ionic conductors and dielectrics is followed by a review of previous practical work and a description of the apparatus developed to measure at audio-frequencies and under equilibrium conditions the resistance, capacity and loss angles of lime-alumina-silica mixtures freezing at 1,266° C. The electrode assemblies constructed permit

measurements of these properties to be carried out over the melting range when complete fusion of the mixture is possible, or to just above the solidus temperature when such fusion is not possible.

In the solid state up to about 1,200° C. the temperature/resistance relationships conform to the usual expression: $R = ae^{E/KT}$, the activation energy of conductivity, E, ranging from 20-40 k.cal/mol, if a state of true physical equilibrium is realised. Above 1,200° C. the phenomenon known as "premelting" occurs, the slope of the temperature/resistance curve increasing progressively up to the solidus temperature, this fall of resistance being paralleled by a rise of capacity. In the premelting range it has been shown that "undercooling" can take place, the mechanism of this phenomenon being closely related to that of nucleation. At the solidus temperature an abrupt fall in the slope of temperature/resistance and temperature/capacity curves occurs, further increase in the liquid content with temperature rise producing a progressive reduction in the rate of change of resistance and capacity. There may, or may not, be a break in the curves at the liquidus temperature. The onset of premelting causes an abrupt rise in the loss angles of the mixtures, the value reaching a sharp maximum close to the solidus temperature for most frequencies in the audio range, provided that resistance and capacity are measured under true equilibrium conditions.

Up to the solidus temperature the frequency/resistance and frequency/capacity relationships respectively conform to the expressions $R = A/f^m$ and $C = B/f^n$. The variations of the constants m and n have not been satisfactorily related to theory, and it is suggested that the expressions may reflect the effects of electrolytic polarisation. Above the solidus temperature the resistance of the mixtures is inversely proportional to frequency, a fact which can be atttributed to polarisation effects resulting from the use of thin bright electrodes. The frequency/loss relationships suggest that there is a marked drop in the relaxation time just below the solidus temperature, absorption peaks appearing below 10,000 c/s. Although dielectric absorption in the mixtures may tentatively be attributed to Maxwell-Wagner ionic mechanisms, quantitative confirmation is prevented by the unknown effects of electrolytic polarization.

The importance of the method for research on silicate and other mixtures is stressed and possible applications are considered.

CERAMIC DRIERS

PART III

by

LEO WALTER, A.M.I.Mech.E., M.Inst.F.

WITH the rapid increase in making rates for ceramic goods which has taken place during recent years, it has become very important to effect drying of clay ware in the minimum possible time. Various precautions have, however, to be taken for avoiding too sharp drying, which might cause surface hardening, cracking, and other troubles, well known to the pottery engineer.

To perform continuous rapid hot air drying of clay ware without affecting the quality of the goods requires a carefully designed drying plant. In the following a few recently developed modern conveyorised convection driers are described and illustrated. They incorporate the following features: (a) good controllability of hot air temperature and of air humidity; (b) the use of larger air velocities; (c) application of closely controllable recirculation of air; (d) possibility of altering the drying cycle to ware for drying after dipping, and use either live steam or exhaust steam, or both.

Heat in older types is applied by radiation and natural convection, and drying times might be anything up to 15 hours or more. More modern mangles use fan circulation of air, with air blast into the glaze-dipped ware at about 140° F. One example of this modern mangle will be described in the following. Modern mangles are also widely used for drying of flat and holloware in moulds for initial drying. Either Town's gas or exhaust steam can be the heating medium, and hot air temperatures of

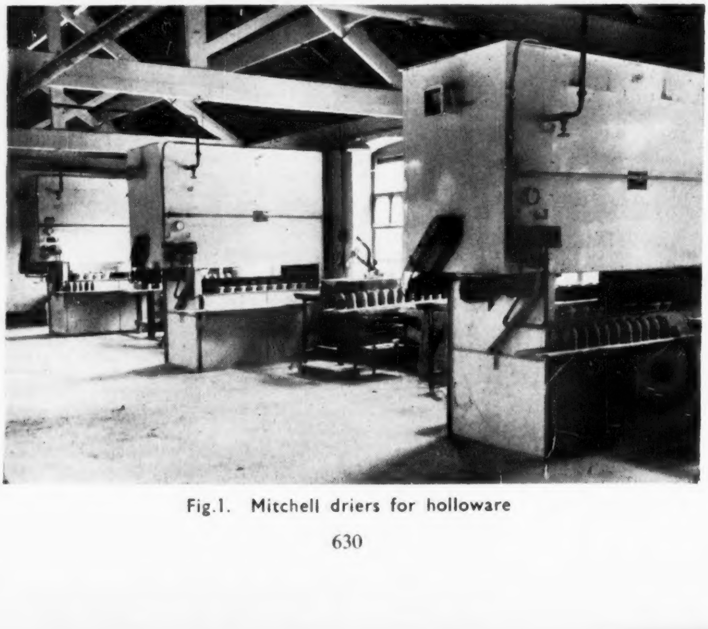


Fig.1. Mitchell driers for holloware

about 170° F. are used for cup drying in about 20 min. The advantage of modern mangles over the old drying rooms is obvious. Factory output can be maintained at will with the use of a smaller number of moulds. The makers claim also the use of less steam per dried unit with consequent fuel savings.

All modern mangles have provision for recirculating the air to the most effective degree of saturation at the exhaust outlet. A secondary but not less important aspect of recirculation is the close control over the humidity inside the drier. By mixing at will humid recirculated exhaust air with dry heated fresh inlet air an even drying without setting up internal stresses in the clay can be secured.

Design Features of Mangles

According to the head-room available modern mangle driers can be either designed with single upward and downward passes, or they can be arranged on the multi-pass system. Whatever design is used, provision has to be made for an adequate mould storage in the machine according to desirable rate of feed. Using modern mangles the operator is positioned to work in close proximity to the drying machine, servicing the feed batch. The loading of trays can thus be effected with a minimum of movement by the maker. After stripping, the moulds are returned direct to the makers for re-use, without mould runners. Work proceeds simultaneously on both sides of the machine, because a tray is brought in sight of each of the batches at the same time. Modern mangles have a stop/start push button for manual control by the maker. A trip gear operating through limit switches ensures the satisfactory placing of each tray ready for loading, thus the whole drying cycle is under the control of the maker to suit the making rate of the machine.

Flatware Driers

Amongst the various considerations for drying of freshly made claywares, the most important is the danger of surface cracking at about 80° C. or above. Another well-known fact is that plaster of paris moulds can be seriously damaged if drier temperatures exceed 70° C. Flatware driers have been developed, however, which keep drier and mould temperatures within safe limits, and have better thermal efficiency and satisfactory output.

Fig. 1 illustrates a drier, designed to facilitate straight line flow of work through the shops where careful motion study ensures that unnecessary movement of workers is avoided, and also the use of ancillary labour is kept to the minimum. It dries holloware to mould release ready for sponging

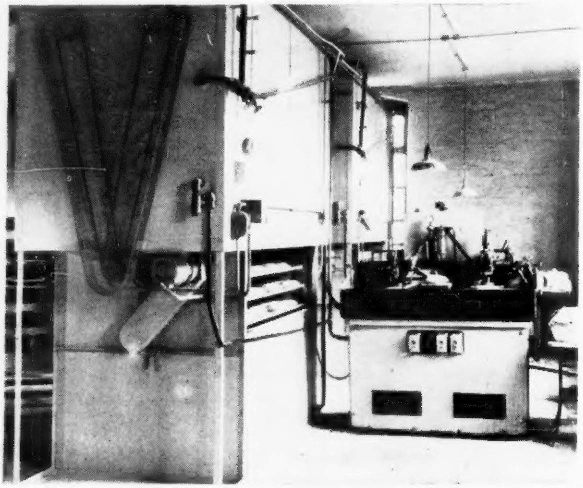


Fig. 2. Single pass drier for small flatware

up to a rate of 12 per min. The size of this and of the other machines is governed only by the making rate and drying cycle.

For small flatware (say 5 in. dia.) and for saucers, the single pass drier, as shown in Fig. 2 will usually cater for the output from a semi-automatic machine at a rate of seven pieces per min. The larger Mitchell flatware drier, as shown in Fig. 3 has been designed in various sizes for all classes of ware, up to 10 in. at the maximum, making rates for automatic machine making.

Tunnel Type Truck Stoves

With periodic truck driers the ware is placed inside an enclosure, loaded on trucks. Output is higher than with tray driers but progressive tunnel systems have to be used for large continuous production. The ware is loaded on to a truck, and either a monorail or a track system moves the material through the tunnel.

A modern tunnel drier has air distribution as to ensure the same rate of evaporation on all surfaces of the ware. Draw off for humid air during progressing from one zone to the next ensures controlled air humidity during movement of the ware. For scientific operation, a drying schedule has to be worked out for each product, clearly indicating temperature and humidity conditions. Measuring instruments supervise these drying factors, and in larger installations automatic temperature and humidity control is used.

Driers of the progressive tunnel type are extensively used for all types of ceramic products, such as sanitary ware, pressed porcelain, glass pots, including refractory brick, crucibles and moulded insulation goods.

One of the most modern installations in this country comprises twenty Mitchell hot air drying stoves, each arranged as double ten-truck units, with two pairs of doors. Each tunnel drier is fitted with a Cambridge programme controller for controlling the drying cycle. Time-temperature control thus ensures the desired drying curve for each type of ware. For example, when drying clay ware, where temperature has to be kept moderate during the early drying stages, a cam attachment to the time

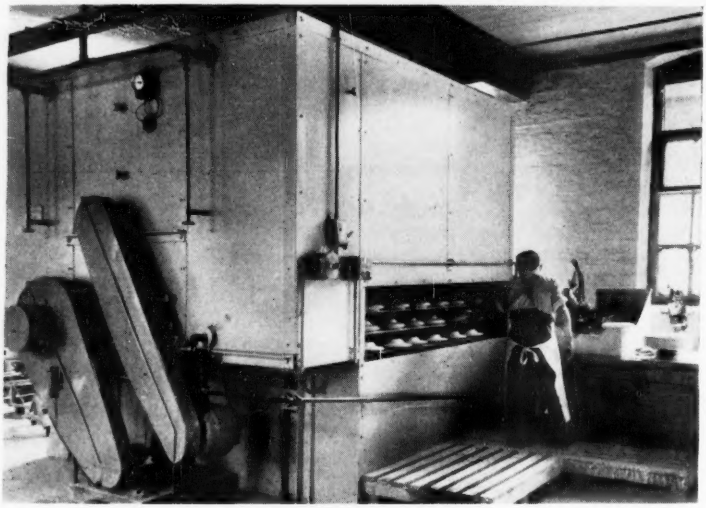


Fig. 3. Large Mitchell flatware drier

cycle controller is cut out according to the required drying curve. The cam is cut out according to the time temperature cycle required, controlling by means of a control mechanism, steam admission to the heater battery.

Fig. 4 illustrates a large tunnel drier with a capacity of forty-two trucks. Similar stoves are used for drying of electrical insulators, extruded clay

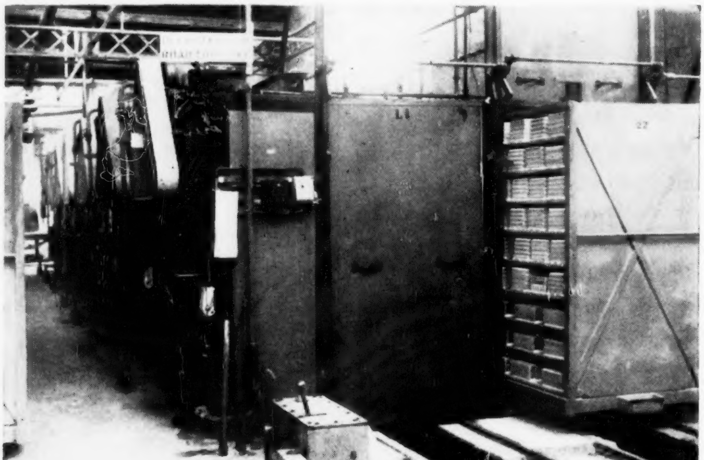


Fig. 4. Tunnel drier with capacity of forty-two trucks

blanks, tiles, press ware, and they are also used for drying after glazing. The above drier types incorporate an efficient system of horizontal air recirculation with close contact between the hot air and the material to be dried. Several propeller fans ensure good heat transfer from the heater battery coils to the recirculated air. Adjustable air dampers allow control of humidity conditions. Modern installations incorporate automatic humidity control with controlling hygrometer and lever - operated dampers.

The experimental work performed with infra-red drying has lead to a number of radiant heat drier types which are satisfactory in operation. Their main advantage is, of course, shortening of drying time. In a typical installation the overall length of the oven is 24 in. and fourteen gas-heated infra-red panels are fitted into the roof above the conveyor or band. A $\frac{1}{4}$ h.p. motor drives the belt over a reduction gear with roller chain drive. The width of the conveyor belt is 3 ft. 3 in. At the drive end a 9 in. dia. propeller fan produces air recirculation, the path of air being beneath the lower conveyor section towards the feed end. Overall height of the stove is 4 ft. 3 in., and width inside oven is 3 ft. 9 in.

The writer is indebted to L. A. Mitchell Ltd., of Manchester, for permission to use the photographs in the above article.

REFERENCE

S. R. Hind. Drying in the Pottery Industry. "A Study of Drying." *Journal of the Institute of Fuel.*

CERAMIC PATENTS REVIEW

CLAY PULVERISING. Combustion Engineering Super-Heater Inc. (B.P. 652,035, 16.7.47).

An apparatus whereby the main part of a mixture is a soft ingredient containing some harder material, and is passed between grinding surfaces which have sufficient resilience not to grind the unwanted harder material but which, nevertheless, grinds the softer material. Afterwards the hard ingredient can be removed by centrifugal separation. A machine to carry out both these operations is described.

Ceramic Material. G. and W. H. Corzon Inc., Assees of C. R. Brown (B.P.653,070, 1.4.48. U.S. 4.4.47).

This mixture is constituted from a grog made from coal-ash slag together with not less than 80 per cent. fly-ash. It is plasticised with or without plastic clay in water, after which it is shaped, dried and subsequently fired to that temperature necessary to produce a reddish vitrified material. It is mentioned that the shrinkage on firing of the material is less than 5 per cent. whilst the grog used may be fireclay, brick, flint, etc.

Tile Making. A. P. De Gannes (B.P. 652,957, 31.8.48).

This machine is a vibratory table with an interchangeable multi-mould plate and there is a set of grid members which are pivoted and which constitute the sides of the different moulds. When the cavities in the mould have been filled, these grid members are swung outwards whilst an ejector removes the mould plate which in turn carries the shaped pieces.

Casting Pottery. Royal Crown Derby Porcelain Co. Ltd., and P. I. Robinson (B.P. 652,418, 31.1.48).

This described a travelling mould carrier which is designed to engage with a container for the slip which moves in such a way that for a definite distance the slip container moves with the mould whilst the slip is poured into the mould. At this stage the slip container becomes disengaged from the mould carrier so that the flow of slip is automatically stopped. Whilst the slip is being poured into the mould the latter is rotated about its own axis.

Glazing Ceramic Ware. H. V. Schweitzer (B.P. 653,677 and 653,248, 8.8.47. U.S. (A) 6.4. and (B) 7.6.40).

This is an automatic machine with a rotating table around the outside of which there is a series of spindles which rotate, in the heads of which the ware is

held. The ware passes a part of the installation where it receives successive thin coats of glaze slip sprayed from air pistols which oscillate. A similar machine which is adapted for glazing, banding, stamping and sand blasting, is described.

Ceramic Materials. L. Bonnet (B.P. 653,980, 16.8.48. Fr. 18.8.47).

High temperature and electrical insulating ceramics may be prepared from aluminium oxide, Al_2O_3, zirconum oxide, ZrO_2, zirconate or titanium oxide, TiO_2, and it is possible to reduce the firing temperature by adding from 5-20 per cent. of a eutectic mixture of equal parts of magnesium zirconate and kaolin. The former constituents may be replaced by a double zirconate of calcium and magnesium. Another claim is a method of producing a high temperature glaze which will withstand reducing conditions by the use of a thick slip formulated by the addition of finely ground and subsequently fired mixture zirconum silicate and the above-mentioned eutectic after an aqueous solution of aluminium chloride $AlCl_3$ has been added.

A Pottery Machine. F. L. Howard and W. R. Howard (B.P. 650,285, 22.6.48).

This is an attachment whereby independent foot pedals control the power drive to the jolly head as well as the movement of the jolly arms.

Insulating Block Binder. C. C. Callis, Assr. to Armstrong Cork Co. (U.S.P. 2,502,418, 4.4.50. Appl. 13.12.45).

The slurry is made by mixing alkali-metal aluminate 2 mol. with an alkaline-earth-metal hydroxide 3 mol. and water. From 60-90 per cent. of the filler is added to this slurry, and afterwards the mixture is made into blocks by pressure. It is dried at from 65°-205° C. and then cut to the required sizes.

Moulds for Casting. R. E. Birch, Assr. to Harbison-Walker Refractories Co. (U.S.P. 2,508,006, 16.5.50. Appl. 21.2.47).

A refractory mould for metals which can be cast above a temperature of 1,400° C. and which is of a non-per manent character can be made with a surface in contact with the metal consisting of lime—$Ca(OH)_2$ and silica—SiO_2 in the ratio of the former, 58·42-69 parts and the latter 31 parts, in a manner which forms not more than 10 per cent. of unstable calcium orthosilicate during the casting process. A refractory which is considered suitable consists of magnesium-iron olivine sand or dunite—N. Carolina sand—in the ratio of 56·1 per cent. of either of these materials and lime, $Ca(OH)_2$—43·9 per cent.

Refractories—Electrical Conducting. J. M. Mochel, Assr. to Corning Glass Works (U.S.P. 2,490,825/6, 13.12.49. Appl. 1.2.46).

To reduce the electrical restivity of tin containing refractory bodies, an addition of either an oxide of arsenic, antimony, tantalum or bismuth, together with a shrinking agent such as an oxide of nickel, cobalt, iron, manganese, copper, silver, gold or zinc, or, alternatively, 0·2-5 per cent. of antimony or bismuth oxide, 2 per cent. of uranium oxide, and 0·5-2 per cent. of the oxide of nickel, cobalt, iron, manganese, copper, silver, gold or zinc.

It is claimed that the material will not be corroded by molten glass and may be used as electrodes when glass is being melted electrically.

(With acknowledgment to "British Abstracts.")

POTTERY PROBLEMS

MEMBERS of the Pottery Section of the British Ceramic Society held a "Question Box" at the North Staffordshire Technical College recently.

MR. RICHARD GREEN (Richards Tiles Ltd.) explained why glazed tiles suffered so great a tendency to craze in service, saying that English tile bodies were very prone to the fault owing to the high moisture expansion and the pinch effect which was experienced with present methods of fixing. It was necessary to find materials to reduce the moisture contents, and to investigate various methods of fixing tiles to walls to set up minimum stresses. He added that to quench the tiles in cold water, after immersion in steam, as a method of testing crazing resistance, was to get further away from conditions of service.

MR. ERIC BENTLEY (Bullers Ltd., Hanley) dealt with the question of the varying Bullers ring values, sometimes obtained on adjacent bats when loading is different in tunnel ovens of a very small cross section. He said it was important that the rings should be considered as a body being matured—as a body that was uniform. If different readings were recorded in different positions in the same heat, he believed the rings were giving a true picture. If identical heat treatment was provided, the readings on the same bat should be

within one point of each other. In adjacent bats, under identical conditions, the variations should be within two points either way.

DR. W. L. GERMAN (secretary of the Pottery Section) led a debate on air-floated clays and possible advantages in their use by potters in this country. He said the name was used to describe ground dry clay which had been classified by an air stream. In America, it was produced by a continuous grinding process in an enclosed pan mill, fed by a current of hot air.

The dried clay, containing about 3 per cent. moisture was collected in dust catchers and was either bagged or put in box cars. It had been produced in this country lately and in America was widely used for the dry mixing process. One difficulty in its use in the dry mixing process in this country was that the use of dry flint was forbidden by factory regulations. As far as wet mixing was concerned, the use of air-floated clays might effect a saving of power and labour in the blunging process. For some articles, the use of dry mixing might not satisfy the requirements for quality ware. At present, air-floated clays were considerably more expensive than materials in current use.

THE CHAIRMAN (Mr. L. Bullin) gave his conclusions drawn from experience gained during a trip to America and Canada. He said the use of dry mixing for tile bodies seemed to be satisfactory, but it was not altogether suitable for electrical porcelain, china and better-class earthenware. Dry mixing was an economic proposition for firms starting from scratch, provided air-floated clays could be obtained at prices between 25-30 per cent. higher than ball clay prices.

MR. A. W. NORRIS (British Ceramic Research Association) explained the incidence of fine green spots on fire-clay sanitary ware fired in a tunnel oven, and their absence when intermittent firing was used. He said the spots were due to the presence of particles of copper beneath the surface either in its metallic form or as a compound mineral. He thought the difference between the methods of firing lay in the question of time and temperature as a secondary cause. The spots tended to disappear if maximum temperatures were kept up for a long time. It was the longer period at high temperatures taken by the intermittent firing process which eliminated the green spots.

MR. A. BAILEY (The North Staffordshire Technical College) explained the high percentage of hair cracks found on filling 7 in. soup moulds for the first time, and why the cracks appeared only on the rim and not at the junction of the

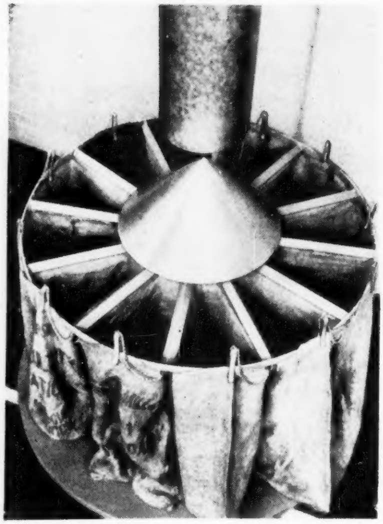
rim and ball. He said he did not believe that painting the mould rim with olive oil would stop the cracking and added that aired water was just as good and did not damage the moulds in any way.

("Evening Sentinel," Hanley.)

MULTI-BAGGING ATTACHMENT

WOOD waste, fine sawdust, or other granular materials which are discharged from an outlet and collected in a sack or similar container, present a handling problem; a considerable one which has been present for many years. The materials build up quickly at the outlet and choking easily occurs, thus requiring the permanent presence of an operator to prevent it happening.

To overcome this problem, Dallow Lambert and Co. Ltd., Leicester, have produced equipment which requires the minimum of attention. The equipment comprises: a steel cone mounted centrally on an iron framework which is divided into twelve sections and supported on a circular metal fabricated base with castors. Our illustration shows twelve empty sacks attached in position; no hooks or straps are employed.



Dallow Lambert and Co. Ltd., multi-bagging attachment

The equipment is placed directly underneath the discharge outlet so that when the material is discharged it is evenly distributed to each of the twelve sacks. To empty the sacks the equipment is moved to one side slightly before the sacks are quite full; this enables half the sacks to be removed and replaced without interrupting the flow of material.

Simplicity of design, coupled with its efficiency, is the most attractive feature of this labour-saving device.

B.I.F. GAS COUNCIL STAND

Glass Working Exhibit

THE use of gas heated appliances in four main branches of industry will be featured on the Gas Council stand at the British Industries Fair, Castle Bromwich, this year. The subjects for special mention are heat treatment, foundry work, glass working and metal spraying.

In the heat treatment section, the exhibits will show the range of temperatures covered by gas heated appliances, from low temperature salt baths and tinning baths, through medium temperature natural draught furnaces and forced air circulation ovens, to high temperature forge furnaces, natural draught furnaces and crucible furnaces. All this equipment is suitable for use in heat treatment shops throughout the country.

The type of equipment shown to illustrate a foundry production line will include core and mould dryers, ladle and blacking dryers, torches, and crucible furnaces. In addition, this section will include types of equipment used in the foundry, including mould ladles and cores, etc.

The metal spraying display will be a demonstration of the use of the spray gun for building up metal components, such as crankshafts, which have been partly worn away by constant use.

The glass working exhibit will show the use of oxy-coal-gas blowpipes for the manual working and shaping of laboratory and industrial glassware, such as is used in atomic research, the iron and steel industries and the gas industry.

Industrial Waste Water Disposal

UNDOUBTEDLY this subject is going to become increasingly important as an aspect of British industry and the present legal position more or less outlines the shape of things to come, with greater enforcement.

The problem in Britain is a very dense population with a very dense industry together with comparatively small rivers. The Rivers Pollution Prevention Act of 1876, and the Salmon and Fresh Water Fisheries Act of 1923 define the legal position whereby a riparian owner can bring action if he suffers damage. Under the latter Act neither fish nor spawn nor food for fish may be destroyed and the Act operates in rivers or estuaries.

In many rivers and estuaries the Acts are strongly enforced and industrial waste must be treated to remove any matter which is either toxic or will cause oxidation. The former Act definitely prohibits the discharge of matter causing pollution either from domestic users or factories into fresh water streams although certain exceptions occur in tidal waters. Thus, in Great Britain a very high proportion of domestic sewerage is treated by removing the sludge using biological filtration, an activated sludge process, or land filtration, so that it contains not more than thirty parts per million of suspended matter and a biochemical oxygen demand not exceeding twenty parts per million. The Public Health (Drainage of Trade Premises) Act of 1937 allows a manufacturer to discharge waste to the district sewers but enables the local authority to exclude any materials in the discharge which would damage the treatment process.

Considerable Treatment

The net result of all this is that for inland industrial areas, industrial waste must receive considerable treatment and where there is sewer discharge, the rate of discharge must be uniform by balancing tanks and so on, or else it is necessary to pretreat by screening, neutralisation or actual removal of the toxic contents. Another point is that although sewers and industrial waste may sometimes be discharged into an estuary without treatment, there is always the possibility that the system will become anaerobic resulting in a public nuisance by the discharge of hydrogen sulphide produced by reducing the sulphate content of the water.

A riparian owner recently took legal action at Luton against the local authority for pollution of the river Lea. He was successful, and sewerage treatment now includes sludge separation treatment by filter-pressing treatment of the settled sewerage by two types of biological processes, removal of humus from the filter effluent by separation and final removal of the remaining suspended matter by micro-straining and rapid sand filtration. The plant produces a waste, free from suspended matter and practically free from organic matter which can be oxidised. The expense to the local authority is obvious. It should not be imagined, however, that local authorities will accept this expensive responsibility without in turn making use of the Public Health (Drainage of Trade Premises) Act which in turn allows them to refuse wastes from manufacturing processes.

Metal Industries

One of the most difficult problems is treatment of waste products from the metal industries. In electroplating pretty well the whole of the discharged wastes are likely to be toxic to bacteria. The concentration of most electroplating constitutents of one to two parts per million will interfere with sewerage treatment. A pound of copper will interfere with one hundred thousand gallons of sewerage, equivalent to from two to four thousand residents. Methods of treating electroplating sewerage are, however, fairly well known but raise another item of capital expenditure to the plater. Copper pickling presents another problem but where sulphuric acid has been used the copper can be recovered pure by electrolysis. Other materials such as chromates and cyanides present acute problems. Cutting oils in waste cause pollution and usually the emulsion is broken by adding a strong electrolyte such as sodium chloride, sulphuric acid and aluminium sulphate when the separated oil can be skimmed off.

Recently Dr. B. A. Southgate of the Water Pollution Research Laboratory, D.S.I.R., published a paper entitled "Disposal of Industrial Waste Waters," in *Chemistry and Industry* of 31st December, 1951, in which he deals with the above points in more detail and gives an outline of the treatments used.

ADVERTISERS' INDEX

This is an Arrow Press Publication. Published Monthly.
Subscription Rate 25s. per annum.
Published by Arrow Press Ltd. at 157 *Hagden Lane, Watford, Herts.*
Telegrams: "Techpress, Watford." Telephone: Gadebrook 2308/9.

MADE AND PRINTED IN GREAT BRITAIN FOR THE PROPRIETORS, ARROW PRESS LTD., BY THE SIDNEY PRESS LIMITED, LONDON AND BEDFORD.